

FRAMEWORKS FOR
VOCATIONAL-TECHNICAL PROGRAMS
REVISED IN
2008-2009

SECONDARY
EXECUTIVE SUMMARY

2009

Executive Summary

Direct inquiries to

Director of Bureau of Vocational Instructional Development
Office of Vocational Education and Workforce
Development
Mississippi Department of Education
P.O. Box 771
Jackson, MS 39205
(601) 359-3940

Robin Parker, EdD
Coordinator of Curriculum
Research and Curriculum Unit
P.O. Drawer DX
Mississippi State, MS 39762
(662) 325-2510
robin.parker@rcu.msstate.edu

Additional copies

Research and Curriculum Unit for Workforce Development
Vocational and Technical Education
Attention: Reference Room and Media Center Coordinator
P.O. Drawer DX
Mississippi State, MS 39762
<https://cia.rcu.msstate.edu/curriculum/download.asp>
(662) 325-2510

Published by

Office of Vocational Education and Workforce
Development
Mississippi Department of Education
Jackson, MS 39205

Research and Curriculum Unit for Workforce Development
Vocational and Technical Education
Mississippi State University
Mississippi State, MS 39762

The Mississippi Department of Education, Office of Vocational Education and Workforce Development does not discriminate on the basis of race, color, religion, national origin, sex, age, or disability in the provision of educational programs and services or employment opportunities and benefits. The following office has been designated to handle inquiries and complaints regarding the non-discrimination policies of the Mississippi Department of Education: Director, Office of Human Resources, Mississippi Department of Education, 359 North West Street, Suite 359, Jackson, Mississippi 39201, (601) 359-3511.

Preface

Secondary vocational–technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act IV, 2007; and No Child Left Behind Act of 2001).

Table of Contents

Preface	4
Architecture and Engineering	6
Collision Repair Technology	17
Digital Media Technology	26
Installation and Service	42
Information Technology	54
Appendix A: 21 st Century Skills Standards	64
Appendix B: MS Academic Standards	65
Appendix C: ACT College Readiness Standards	67
Appendix D: National Educational Technology Standards for Students	80

ARCHITECTURE AND ENGINEERING

Program Description Architecture and Engineering

Program Description

Architecture and Engineering is a program in pre-architecture and pre-engineering for high school students. The purpose of the program is to provide students with expanded knowledge of the use of technological skills and to enable them to solve problems by applying knowledge in a technological context. The program is designed to provide students with hands-on experiences related to the application of architecture education and engineering concepts in the workplace. Students will develop academic and technical skills, 21st century skills, and human relations competencies that accompany technical skills for job success and lifelong learning. Students who complete the program will be better prepared to enter and succeed in architecture and engineering programs offered by Mississippi community and junior colleges and institutions of higher education.

Industry Certification

Architecture: In most states, the professional degree in architecture must be from one of the 114 schools of architecture that have degree programs accredited by the National Architectural Accrediting Board. However, state architectural registration boards set their own standards, so graduation from a non-accredited program may meet the educational requirement for licensing in a few states.

Three types of professional degrees in architecture are available: A 5-year bachelor's degree, which is most common and is intended for students with no previous architectural training; a 2-year master's degree for students with an undergraduate degree in architecture or a related area; and a 3- or 4-year master's degree for students with a degree in another discipline.

All states and the District of Columbia require individuals to be licensed (registered) before they may call themselves architects and contract to provide architectural services. During the time between graduation and becoming licensed, architecture school graduates generally work in the field under the supervision of a licensed architect who takes legal responsibility for all work. Licensing requirements include a professional degree in architecture, a period of practical training or internship, and a passing score on all divisions of the Architect Registration Examination. The examination is broken into nine divisions consisting of either multiple-choice or graphical questions.

Engineering: Most engineering programs involve a concentration of study in an engineering specialty along with courses in both mathematics and the physical and life sciences. Many programs also include courses in general engineering. A design course, sometimes accompanied by a computer or laboratory class or both, is part of the curriculum of most programs. General courses not directly related to engineering, such as those in the social sciences or humanities, are also often required.

In addition to the standard engineering degree, many colleges offer 2-year or 4-year degree programs in engineering technology. These programs, which usually include various hands-on laboratory classes that focus on current issues in the application of engineering principles, prepare students for practical design and production work, rather than for jobs that require more theoretical and scientific knowledge. Graduates of 4-year technology programs may get jobs similar to those obtained by graduates with a bachelor's degree in engineering. Engineering technology graduates, however, are not qualified to register as professional engineers under the same terms as graduates with degrees in engineering. Some employers regard technology program graduates as having skills between those of a technician and an engineer.

All states and the District of Columbia require licensure for engineers who offer their services directly to the public. Engineers who are licensed are called professional engineers (PEs). This licensure generally requires a degree from an ABET-accredited engineering program, 4 years of relevant work experience, and successful completion of a state examination. Recent graduates can start the licensing process by taking the examination in two stages. The initial Fundamentals of Engineering (FE) examination can be taken upon graduation. Engineers who pass this examination commonly are called engineers in training (EIT) or engineer interns (EI). After acquiring suitable work experience, EITs can take the second examination, the Principles and Practice of Engineering exam.

Articulation

The following articulation plan is in place for the Architecture and Engineering Pathway.

Architecture and Engineering	PS Drafting and Design Tech	DDT 1113/4 – Fundamentals of Drafting (effective 2006) DDT 1313 – Principles of CAD (effective 2005)
	PS Civil Tech	DDT 1113/4 – Fundamentals of Drafting DDT 1313 – Principles of CAD

Assessment

Students will be assessed using the Secondary Architecture and Engineering MS-CPAS2 test. This exam will be administered to students during the fourth Carnegie unit.

Student Prerequisites

In order for students to experience success in the Architecture and Engineering program, the following prerequisites are recommended:

C or Higher in Pre-Algebra

or

TABE Math Computation and TABE Math Applied Score (eighth grade or higher)

or

Instructor Approval

Applied Academic Credit

Applied Mathematics content from the curriculum was aligned to the 2007 Mississippi Mathematics Framework Revised Academic Benchmarks. Upon the completion of this program, students will earn 1/2 Applied Mathematics credit that can be used for graduation requirements.

Executive Summary

Applied Physics content from the curriculum was aligned to the 2010 Mississippi Science Framework Revised Academic Benchmarks. Upon the completion of this program, students will earn 1/2 Applied Physics credit that can be used for graduation requirements.

Licensure Requirements

The ____ licensure is needed to teach the Architecture and Engineering program. The requirements for the ____ licensure endorsement are listed below:

1. Applicants must have a bachelor's degree or higher in mathematics education or science education or a bachelor's degree or higher in mathematics or science AND hold a 5-year teaching license.
2. Applicants must successfully complete an MDE-approved computer literacy certification exam.
3. Applicants must successfully complete certification for an online learning workshop, module, or course that is approved by the MDE.
4. Applicants must successfully complete endorsement training approved by the MDE.

Note: If an applicant meets all requirements listed above, that applicant will be issued a ____ endorsement to add to his or her 5-year license.

Professional Learning

Information Technology Professional Learning Plan for Summer 2009

For specific training information, please visit <http://redesign.rcu.msstate.edu>.

- Teachers will receive training related to new curriculum content.
- An assessment meeting will be conducted during or after curriculum training sessions.
- Teachers will be required to complete all licensure requirements within 3 years of obtaining new endorsement.

Writing Team Members

Danny Browning, New Hope High School, Columbus, MS
Andy Gunkel, Gulfport Vocational Center, Gulfport, MS
Jennifer Hood, Monroe County Vocational Center, Amory, MS
Mary Beth Lowrey, Oxford-Lafayette Vocational Center, Oxford, MS
Patrick Ray, West Point Career and Technology Center, West Point, MS
Susie Shorter, Greenville Vocational Complex, Greenville, MS
Krystyna Tate, Claiborne County Vocational/Technical Complex, Port Gibson, MS
Dexter Wilson, Franklin County Vocational/Technical Complex, Meadville, MS

Task Force Members

Tom Bryant, Engineering Associates, Inc.
Phil Cockrell, Copeland and Johns
Dr. Paul Cuicchi, Starkville Public Schools
Sharon Hudson, Mississippi Department of Education
Carol Ingram, Lamar County Public Schools
Jeff Jones, Mississippi Gulf Coast Community College
Mattie Jones, Pontotoc Career Center
Jean Massey, Rankin County Schools
Jim McRae, Clearspan
Dr. Phyllis Miller, Mississippi State University
Myra Pannell, Research and Curriculum Unit
Dr. Robin Parker, Research and Curriculum Unit

Executive Summary

Cindy West, Hinds Community College

Jennifer Wilson, Rankin County Public Schools

Course Outlines

Program CIP Code: 14.0401

This curriculum framework is divided into four one-Carnegie-unit courses as outlined below. The first two courses are comprised of units from Architecture and Engineering Year 1. The last two courses are comprised of units from Architecture and Engineering Year 2.

Architecture and Engineering Fundamentals (One Carnegie Unit)

Unit	Title	Hours
1	Orientation and Safety	8
2	Engineering History, Ethics, and Careers	12
3	Engineering Fundamentals, Materials, and Resources	100
4	Writing, Presenting, and Project Management	20
		140

Architecture and Engineering Design (One Carnegie Unit)

Unit	Title	Hours
1	Engineering Design Process	40
2	Sketching and Modeling	60
3	Production, Quality Control, and Engineering Failure	40
		140

Systems in Architecture and Engineering (One Carnegie Unit)

Unit	Title	Hours
1	The Four Systems	80
2	CIM—Computer Integrated Manufacturing	60
		140

Applying Architecture and Engineering Concepts (One Carnegie Unit)

Unit	Title	Hours
1	Digital Electronic Control System Technology	20
2	Workforce Readiness	20
3	Self-Directed Project	100
		140

Architecture and Engineering Fundamentals

Course Name: Architecture and Engineering

Course CIP Code: 14.0401

1. Identify course expectations, school policies, and program policies related to this course.
 - a. Identify school rules, policy, and procedures.
 - b. Identify and establish classroom guidelines and procedures.
 - c. Review course standards and affiliated national standards.
 - d. Review the comparison of self- and classroom expectations.
2. Demonstrate proper use and care for laboratory equipment.
 - a. Identify, describe, and demonstrate the importance of safety and the proper use of lab equipment.
 - b. Describe the operating procedures for the equipment utilized in the course.
 - c. Compare and contrast safety issues in the classroom to safety issues in industry.
3. Explore the history of engineering, its major achievements, and key figures.
 - a. Identify the characteristics of engineers.
 - b. Identify the key contributors in the field of engineering.
 - c. Identify historical engineering designs, and tell what effects it has on today's society.
4. Recognize the importance of ethical teamwork in the field of engineering.
 - a. Identify successful team attributes.
 - b. Practice teamwork collaboration to construct an engineering device.
 - c. Define ethics, etiquette, and morality as they are related to the workplace.
 - d. Compare and contrast engineering ethics in the United States to engineering ethics in other countries.
 - e. Examine the effects of discrimination and stereotyping within a team.
5. Investigate careers within the field of engineering.
 - a. Investigate the different fields of engineering and careers within each.
 - b. Investigate the career you are most interested in, and plan for further study (beginning of electronic portfolio).
6. Explore concepts associated with physical principles of engineering.
 - a. Define and illustrate principles of force, motion, and torque.
 - b. Describe Newton's laws of motion.
 - c. Test structures against various environmental factors.
7. Explore mechanisms and simple machines.
 - a. Distinguish between machines and mechanisms.
 - b. Define and construct the six simple machines.
 - c. Define, calculate, and demonstrate gear ratios, AMA (actual mechanical advantage), and IMA (ideal mechanical advantage).
 - d. Students will design and build a device to use to show force, motion, and/or torque using simple machines (trebuchet, catapults, backhoe, pulley system, etc.).
8. Create a technical report.
 - a. Examine the importance of correct grammar in a technical document.
 - b. Compose an outline and a technical paper on a career in engineering from Unit 2.
9. Know and be able to use the correct forms for presenting reports.

- a. Develop and deliver a presentation based on the research conducted in the chosen engineering field from Unit 2, demonstrating appropriate communication techniques such as voice quality, posture, attire, eye contact, preparation, and confidence.
- 10. Recognize the importance of project planning and documentation.
 - a. Examine the aspects of teamwork and project management in the workforce.
 - b. Prepare e-portfolio for potential employers.
 - c. Compose technical directions to construct a useful product from provided materials.

Architecture and Engineering Design

1. Recognize the need for a design process.
 - a. Define the design process.
 - b. Identify items designed by engineers and those not designed by engineers.
2. Examine how the design process is used to create and modify products and inventions.
 - a. Follow the design process to modify a product or invention.
 - b. Apply concepts of planning, design, building, testing, quality assurance, and customer needs.
3. Create 2-D and 3-D models with CAD software.
 - a. Trace the history of drafting and design.
 - b. Identify drafting and design applications in business and industry.
 - c. Identify terms and concepts related to drafting and design.
 - d. Demonstrate the proper use of scales, including engineering, architectural, and metric scales.
 - e. Distinguish between the types of drawing views: Orthographic, isometric, and perspective.
 - f. Identify and design 2-D and 3-D engineering drawings.
 - g. Construct and print a 3-D engineering assembly drawing.
 - h. Animate a 3-D engineering drawing.
4. Explore the processes of manufacturing and production.
 - a. Define terms associated with manufacturing.
 - b. Identify the major commands and components of CAD/CAM software.
 - c. Design a part to be produced on a milling machine.
5. Explore the methods of quality control.
 - a. Describe basic concepts of quality control technology.
 - b. Perform applications of quality control technology.
6. Explore the causes and effects of engineering failure.
 - a. Examine the effects of engineering failures on structures.

Systems in Architecture and Engineering

1. Examine electrical systems in engineering.
 - a. Identify and define terms associated with energy.
 - b. Calculate total energy usage for the student's own house.
2. Examine fluid systems in engineering.
 - a. Identify and define terms associated with fluid systems in engineering.
 - b. Construct a small hovercraft.
3. Examine mechanical systems in engineering.
 - a. Identify and define terms associated with mechanical systems in engineering.
 - b. Assemble mousetrap-powered cars.
4. Examine thermal systems in engineering.
 - a. Construct a model house that uses solar power.
 - b. Identify and define terms associated with thermal systems in engineering.
5. Design and write a program for controlling a robot.
 - a. Identify the terms associated with CIM and the components of a work envelope and a robot.
 - b. Manually control a robot.
 - c. Compose and execute a simple program to control the robot.
 - d. Compose and execute a complex program to control the robot.
6. Design and create an object using NC code
 - a. Label a diagram of the CNC machine to show its components and safety features.
 - b. Create and execute an NC program to create a design specified by the teacher.
 - c. Create and execute an original NC program to create a three-dimensional object.
7. Set up the CIM cell using the robot and CNC machine.
 - a. Create and post warning signs for the CIM cell, and mark the work envelope with tape on the work surface.
 - b. Write and synchronize an NC program and a robot program.

Applying Architecture and Engineering Concepts

1. Describe applications of electronic control systems technology.
 - a. Use electronics vocabulary to lead and conduct group discussions.
 - b. Compare past and modern electronics as well as the notable electrical engineers who created them.
 - c. Identify and use the tools used in designing a digital device.
2. Apply concepts of electronic control systems technology.
 - a. Conduct practical exercise to identify components of electronic control system technology.
 - b. Construct truth tables associated with the AND, NAND, NOT, NOR, and OR gates.
 - c. Engage in a practical exercise to construct and demonstrate projects that will utilize breadboards, wires, sensors, infrared sensors, touch sensors, speed controls, and relays.
3. Develop employability skills that will prepare students for the world of work.
 - a. Recognize diversity in the workplace.
 - b. Examine examples of correctly formatted job applications, resumes, and job interviews in preparation of creating these materials.
4. Use science, technology, engineering, and mathematical principles and concepts to create solutions for real-world problems related to a career of interest.
 - a. Find a solution to a problem related to a career of interest.
 - b. Use problem-solving skills to research and analyze the problem for possible solutions.
 - c. Develop and test models related to the solution.
 - d. Present the best solution related to the problem.
 - e. Prepare an e-portfolio for use in the workplace.

COLLISION REPAIR TECHNOLOGY

Program Description Collision Repair Technology

Program Description

Collision Repair Technology is a course for students in the Transportation career cluster. The following description is from the current Standard Course of Study for Career-Technical Education, Mississippi Department of Education. This course will be fully implemented in the 2009–2010 school year.

For Option 1, Collision Repair Technology I (two Carnegie units) is a hands-on program that will prepare students for employment or continuing education in the collision repair industry. Collision Repair Technology I content includes instruction in the foundation skills related to safety; tools and equipment usage; measurement; non-structural and structural analysis and damage repair; mechanical and electrical; and painting and refinishing. Collision Repair Technology II (two Carnegie units) provides students with advanced skills related to non-structural and structural analysis and damage repair; mechanical and electrical; and painting and refinishing. Upon satisfactory completion of Collision Repair Technology I and Collision Repair Technology II, students will earn four Carnegie units.

For Option 2, Introduction to Collision Repair Technology (one Carnegie unit) is a 1-hour course designed to provide foundation skills related to safety; tools and equipment usage; and measurement. Collision Repair Technology I (two Carnegie units) is a hands-on program that will prepare students for employment or continuing education in the collision repair industry. Collision Repair Technology I content includes instruction in the skills related to non-structural and structural analysis and damage repair; mechanical and electrical; and painting and refinishing. Collision Repair Technology II (two Carnegie units) provides students with advanced skills related to non-structural and structural analysis and damage repair; mechanical and electrical; and painting and refinishing. Upon satisfactory completion of Introduction to Collision Repair Technology (one Carnegie unit), Collision Repair Technology I (two Carnegie units), and Collision Repair Technology II (two Carnegie units), students will earn five Carnegie units.

The program is aligned with the NATEF 2006 Collision Repair and Refinishing standards, which were retrieved October 1, 2008, from <http://www.natef.org>.

Industry Certification

The Collision Repair Technology program includes classroom and hands-on experiences that will prepare students for employment or continuing education in the collision repair industry. This program was written to incorporate the **National Automotive Technicians Education Foundation (NATEF)** and the **Inter-Industry Conference on Auto Collision Repair (I-CAR)** learning objectives, content, and hours. Any student who successfully completes this program will be eligible to apply to obtain the ASE exams. ASE requires 2 years of employment before certificates are issued. Students receive 1 year of credit for completion of the secondary program. Students who take certifications before the 2-year requirement is met will be granted certifications after they complete 1 year of collision repair employment. NATEF and I-CAR are

national certifications recognized throughout the automotive service industry. Each district should implement a maximum student number due to the size of each lab. Programs seeking certification (NATEF) may receive certification in Painting and Refinishing. Programs can seek certification in other areas if they so desire.

Articulation

This program was designed to articulate to postsecondary Collision Repair Technology. Industry standards are based on the NATEF and I-CAR areas of certification (Painting and Refinishing).

Student Prerequisites

In order for students to be able to experience success in the Collision Repair Technology program, the following student prerequisites are in place:

1. C or Higher in English (the previous year)
 2. C or Higher in Math (last course taken, or the instructor can specify the math)
 3. Instructor Approval
- or
1. TABE Reading Score (eighth grade or higher)
- or
1. Instructor Approval

Applied Academic Credit

Applied Mathematics content from the curriculum was aligned to the 2007 Mississippi Mathematics Framework Revised Academic Benchmarks. Upon the completion of this program, students will earn one Applied Mathematics Credit that can be used for graduation requirements.

Licensure Requirements

The ____ licensure is needed to teach the Collision Repair Technology program. The requirements for the ____ licensure endorsement are listed below:

1. New teachers hired after June 30, 2008, must have an associate's degree in an appropriate field.
2. Applicants must have 2 years of documented collision repair service experience.
3. Applicants must attend the first available Best Practices session and enroll in the VIP program.
4. Applicants must hold ASE certificates in Painting and Refinishing or I-CAR Paint and Refinishing certification.
5. Applicants must successfully complete an approved computer literacy certification exam.
6. Applicants must successfully complete a certification for an online learning workshop, module, or course that is approved by the Mississippi Department of Education.
7. Applicants must successfully complete a certification workshop, module, or course that is approved by the Mississippi Department of Education.

Professional Learning

Information Technology Professional Learning Plan for Summer 2009

For specific training information, please visit <http://redesign.rcu.msstate.edu>.

- Teachers will receive training related to new curriculum content.
- An assessment meeting will be conducted during or after curriculum training sessions.
- Teachers will be required to complete all licensure requirements within 3 years of obtaining new endorsement.

Writing Team Members

Wade Jackson, Oakley Training School, Raymond, MS
Sheddrick Lewis, Amite County School District, Liberty, MS
James Terrell, Oakley Training School, Raymond, MS
Ray Orr, Itawamba Community College, Tupelo, MS
Eddie Ellis, Holmes Community College, Goodman, MS
Jackie Brown, Northwest Community College, Senatobia, MS

Task Force Members

Dean Batton, Simpson County Vocational Center
Annie Covington, Coffeeville Public Schools
Linda Davis, Millsaps Vocational Center
Dave Ellison, Hinds Community College
Jimmy Flynt, Empire Trucks
Scott Kolle, Research and Curriculum Unit
Rick McDonald, Mississippi Gulf Coast Community College
Ted Mangum, Jones County Vocational Center
Michael Myrick, Canton Career Center
Tommy Nance, Fowler Buick
Ray Orr, Itawamba Community College
Danny Owen, Tupelo Public Schools
Ben Pratt, Northeast Mississippi Community College
Rick Saucier, Hancock County Vo-Tech Center
Chad Smith, Smith Brothers Collision Repair
Dale Smith, Thomson Machinery
Cravin Turnage, Holly Springs Public Schools
Earl White, Mississippi Department of Education

Course Outlines

Program CIP Code: 47.0603

Option 1

This Collision Repair Technology option also emphasizes industry-based content with time being allocated between lecture and lab activities. The content is aligned with National Institute for Automotive Service Excellence (ASE) standards to ensure that programs can be recommended for certification by National Automotive Technicians Educational Foundation (NATEF) and the Inter-Industry Conference on Auto Collision Repair (I-CAR) learning objectives and content.

The content is divided into 2 years. The 1st-year content is Fundamentals (Introduction, Safety, Tools, and Measurement along with introductory business principles); Basic Mechanical/Electrical Components; Basic Non-Structural Analysis and Damage Repair; Basic Structural Analysis and Damage Repair; and Basic Painting and Refinishing. The 2nd-year content is Advanced Non-Structural Analysis and Damage Repair; Advanced Structural Analysis and Damage Repair; and Advanced Painting and Refinishing. Safety is an integral part of every course and activity. A student must complete both years to be a completer and to receive the one Math credit.

Collision Repair Technology I (Course Code: _____)

Unit	Title	Hours
1	Fundamentals	100
2	Basic Mechanical and Electrical Components	30
3	Basic Non-Structural Analysis and Damage Repair	30
4	Basic Structural Analysis and Damage Repair	30
5	Basic Painting and Refinishing	125
		315

Collision Repair Technology II (Course Code: _____)

Unit	Title	Hours
1	Safety (Review), Employability Skills, and Business Skills	80
2	Advanced Non-Structural Analysis and Damage Repair	30
3	Advanced Structural Analysis and Damage Repair	30
4	Advanced Painting and Refinishing	175
		315

- First-year and second-year students are not to enroll in the same course at the same time.
- Students must complete the 1st year with a score of 80/C or higher in class work to advance to the next level.

Option 2

This Collision Repair Technology option also emphasizes industry-based content with time being allocated between lecture and lab activities. The content is aligned with National Institute for Automotive Service Excellence (ASE) standards to ensure that programs can be recommended for certification by National Automotive Technicians Educational Foundation (NATEF) and the Inter-Industry Conference on Auto Collision Repair (I-CAR) learning objectives and content.

The content is divided into 3 years in this option. The 1st year is a 1-hour course: Fundamentals (Introduction, Safety, Tools, and Measurement along with introductory business principles). The 2nd-year content is Basic Mechanical/Electrical Components; Basic Non-Structural Analysis and Damage Repair; Basic Structural Analysis and Damage Repair; and Basic Painting and Refinishing. The 3rd-year content is Advanced Non-Structural Analysis and Damage Repair; Advanced Structural Analysis and Damage Repair; and Advanced Painting and Refinishing. Courses should be scheduled so the student completes all courses in 3 years. This 3-year option is offered to meet local schedules, instructor loads, and student need. A student must complete all 3 years to receive the one Math credit.

Collision Repair Technology Introduction (Course Code: _____)

Course	Title	Hours
1	Fundamentals	100
		100

Collision Repair Technology I (Course Code: _____)

Unit	Title	Hours
1	Basic Mechanical and Electrical Components	30
2	Basic Non-Structural Analysis and Damage Repair	30
3	Basic Structural Analysis and Damage Repair	30
4	Basic Painting and Refinishing	125
		215

Collision Repair Technology II (Course Code: _____)

Unit	Title	Hours
1	Safety (Review), Employability Skills, and Business Skills	80
2	Advanced Non-Structural Analysis and Damage Repair	30
3	Advanced Structural Analysis and Damage Repair	30
4	Advanced Painting and Refinishing	175
		315

- Safety will be reinforced and tested at the beginning of each year and throughout the content.
- First-year, second-year, or third-year students are not to enroll in the same course at the same time.
- Courses/years cannot be taken out of the above order unless the instructor approves. Foundation knowledge in each course must be mastered to move to the next unit.
- Students must complete automotive courses with a score of 80/C or higher in class work to advance to the next level.

Collision Repair Technology Year 1

Course Name: Collision Repair Technology

Course CIP Code: 47.0603

1. Introduce, describe, and distinguish local program and vocational/career technical center policies and procedures.
 - a. Describe local program and vocational/career technical center policies and procedures including dress code, attendance, academic requirements, discipline, and the school technology acceptable use policy and transportation regulations.
 - b. Compare and contrast local program policies, procedures, and expectations to industry policies, procedures, and expectations.
2. Introduce, describe, and express employment opportunities and responsibilities of the collision repair industry.
 - a. Introduce concepts associated with the collision repair industry; describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements.
 - b. Describe basic employee responsibilities and how to communicate effectively in on-the-job situations. Identify and apply the practices that affect employer and employee decision making as it relates to identifying and applying appropriate algebraic formulas to personal finance situations, linear programming to business decisions, and algebraic formulas to personal and business investments.
 - c. Discuss the history of the collision repair industry to include materials, terminology, and techniques.
 - d. Research and report the computerized systems used for estimating collision repairs, measuring damage, and mixing or matching paint.
3. Investigate and replicate leadership skills and personal development.
 - a. Demonstrate effective team-building and leadership skills.
 - b. Model appropriate work ethics.
4. Model general safety rules for working in a shop/lab and an industry setting.
 - a. Explain the importance of following all safety rules and policies (report all on-the-job injuries and accidents), evacuation policy, substance abuse policy, and procedures when working near pressurized or high temperature, and explain electrical hazards and the action to take when an electrical shock occurs when performing collision operations (personal protective equipment, procedures for lifting heavy objects, and MSDS sheets).
 - b. Explain the process by which fires start, fire prevention of various flammable liquids, the classes of fire and the types of extinguishers.
 - c. Identify and demonstrate the safe and proper use of common hand tools.
5. Interpret and apply service specifications and information.
 - a. Locate and interpret service specifications and information, using both print and computerized service information references for vehicle and major component identification numbers (VIN, certification, and calibration labels).
 - b. Interpret and apply information to a specific job on a specific vehicle.
6. Demonstrate measurement practices used in the automotive service.
 - a. Measure the length of an object using a rule to the nearest 1/16 in. and 1 mm.
 - b. Identify the different types of bolts (grade, diameter, length, and thread pitch), nuts, and washers, and describe their appropriate uses.

- c. Identify different glues and sealants used in automotive service, and describe their appropriate uses.
7. Manage personal and business finances to include aspects of employer–employee decision making and consumer credit.
 - a. Design, analyze, and develop business finance concepts and skills.
8. Identify, evaluate, and practice suspension and steering components and systems.
 - a. Complete a work order to include customer information, vehicle identifying information, customer concerns, related service history, and causes and corrections; measure vehicle ride height, and check for front-wheel setback; determine needed repairs.
 - b. Identify and inspect (where applicable) steering linkage geometry (attitude/parallelism), Pitman arm, relay (center link/intermediate) rod, idler arm and mountings, tie rod sleeves, clamps, tie rod ends, steering linkage damper, shock absorbers, upper/lower control arms, upper/lower control arm bushings, shafts and rebound bumpers, and upper and lower ball joints.
 - c. Analyze and diagnose wheel and tire repairs according to manufacturer's specifications.
9. Practice concepts and procedures related to electrical/electronic systems.
 - a. Diagnose electrical/electronic components.
 - b. Diagnose and perform procedures related to the battery.
 - c. Inspect and repair various electrical/electronic components.
10. Diagnose and apply practices related to brakes and braking systems.
 - a. Diagnose various brake components and the replacement/repair procedures.
 - b. Identify and discuss factors related to brake fluid.
 - c. Identify and discuss factors related to brake shoes.
11. Discuss and apply practices related to heating and air-conditioning.
 - a. Identify and comply with environmental concerns relating to refrigerants and coolants.
 - b. Locate and identify A/C system service ports; discuss the procedure of evacuation of the A/C system including checking for leaks and recharging the A/C system with refrigerant; and perform a leak test.
12. Identify and discuss cooling systems.
 - a. Identify and inspect engine cooling and heater system hoses, belts, radiator, pressure cap, coolant recovery system, and water pump.
 - b. Discuss the procedure to recover, refill, and bleed a system with proper coolant and check the level of protection; leak test system and dispose of materials in accordance with EPA specifications.
13. Diagnose and repair active restraint systems procedures and practices.
 - a. Analyze and replace (if needed) components related to seat belts.
14. Inspect, analyze, perform, and evaluate procedures and skills pertaining to non-structural analysis and damage repair.
 - a. Identify, inspect, determine necessary action, and perform that procedure when preparing body components.
 - b. Inspect, analyze, and perform repairs as they relate to outer body panels: Repairs, replacement, and adjustments.
 - c. Determine and perform skills and evaluate procedures as they relate to metal finishing and body filling.
 - d. Identify and determine correct procedure and perform the skill as it relates to metal welding and cutting procedures for non-structural applications.
15. Inspect and apply skills and techniques related to vehicles pertaining to structural and damage repair.

- a. Identify and inspect, determine necessary action, and perform that procedure when performing frame inspection and repair.
 - b. Identify, diagnose, recommend, and/or perform the necessary repair action in unibody inspection, measurement, and repair.
- 16. Identify, analyze, and perform the proper metal welding procedures to complete a repair according to manufacturer's specifications.
 - a. Identify, practice, and evaluate metal welding and cutting procedures for structural applications.
- 17. Identify, perform, and appraise vehicles in regard to painting and refinishing.
 - a. Practice safety precautions for painting and refinishing operations.
 - b. Demonstrate and evaluate surface preparation information and skills.

Collision Repair Technology Year 2

1. Introduce and understand general safety rules for working in a shop/lab and industry.
 - a. Explain the importance of following all safety rules and policies.
2. Demonstrate proper use and care for laboratory equipment related to the collision industry.
 - a. Describe basic employee responsibilities.
 - b. Design a resume and letter of application, and complete a job application.
 - c. Demonstrate an understanding of the impact of consumer credit (advantages and disadvantages of installment loans, applying algebraic formulas to consumer credit).
 - d. Design, collect, and apply information for planning a trip.
3. Inspect, analyze, perform, and evaluate procedures and skills pertaining to advanced non-structural analysis and damage repair.
 - a. Identify and utilize metal finishing and body filling procedures.
 - b. Inspect and diagnose moveable glass and hardware.
 - c. Identify, analyze, and perform operations pertaining to welding.
 - d. Recognize and apply plastics and adhesives.
4. Inspect, analyze, perform skills, and evaluate vehicles pertaining to advanced structural analysis and damage repair.
 - a. Identify, analyze, and perform frame inspection and repair.
 - b. Analyze and determine necessary action to repair unibody inspection, measurement, and repair.
 - c. Perform procedures to fixed glass.
 - d. Identify and perform metal welding and cutting principles and practices.
5. Identify, perform, and appraise vehicles pertaining to advanced painting and refinishing.
 - a. Identify and perform paint-related skills and techniques as they pertain to mixing, matching, and applying.
 - b. Identify and analyze paint defect causes and cures.
 - c. Explain and perform final detail practices.

DIGITAL MEDIA TECHNOLOGY

Program Description Digital Media Technology

Program Description

This program is designed for students who wish to develop, design, and implement projects in the fast growing field of digital media. The program emphasizes the techniques and tools used in digital media and the creative design or content of such media. Both theoretical learning and activity-based learning are provided for students who wish to develop and enhance their competencies and skills. The course focuses on the basic areas of computer graphics, multimedia, and animation. Exposure to state-of-the-art equipment is given through advice by experts from industry. The comprehensive project component provides practical experience toward developing a portfolio of work.

Industry Certification

Research with Mississippi industry suggests that this curriculum should be written to the Adobe Certified Associate Certification. This exam assesses the foundation of digital communication skills students need to create effective communication using digital media tools. This certification was developed after a group of industries met with educators to design the entry-level skill industry standards for Web communication, rich media communication, and visual communication. Additionally, the Final Cut Pro 6.0 is the recognized industry software for video production. The Final Cut Express 4.0 software is a more inexpensive software package that has the same interface as Final Cut Pro 6.0. It is recommended that the curriculum be written to the Final Cut Pro Level 1 Certification.

Articulation

The CIST (Computer Networking; Computer Programming; Web Development Network Security Technology; Database Administration technology) program is currently under revision. Once this program is presented to the State Board of Education in January 2009, an articulation agreement will be in place.

Assessment

Students will be assessed using the Secondary Digital Media Technology MS-CPAS2 test. This exam will be administered to students during the second and third Carnegie units.

Student Prerequisites

An eligible student will have completed the ninth grade and will have an overall B average. Prior to being enrolled in the course, a behavior reference must be obtained from an academic technology teacher.

Licensure Requirements

The ____ licensure is needed to teach the Digital Media Technology program. The requirements for the ____ licensure endorsement are listed below:

1. Applicants with associate's degrees must have at least 2 years of verifiable occupational experience in the past 10 years. Experience must be appropriate to the subject to be taught.
2. Applicants with bachelor's or higher degrees must have at least 1 year of verifiable occupational experience in the past 10 years. Experience must be appropriate to the subject to be taught.
3. Applicants must possess a Final Cut Pro Level 1 Certification.
4. Applicants must possess an Adobe Certified Associate Certification in each of the following areas: Web Communication, Rich Media Communication, and Visual Communication.
5. Applicants must successfully complete the Vocational Instructor Preparation (VIP) program.
6. Applicants must successfully complete an MDE-approved computer literacy certification exam.
7. Applicants must successfully complete certification for an online learning workshop, module, or course that is approved by the MDE.
8. Applicants must successfully complete a Digital Media Technology certification workshop, module, or course that is approved by the MDE.

Note: If an applicant meets all requirements listed above, that applicant will be issued a ____ endorsement—a 5-year license. If an applicant does not meet **all** requirements, the applicant will be issued a 3-year endorsement license, and all requirements stated above must be satisfied prior to the ending date of that license.

Professional Learning

Information Technology Professional Learning Plan for Summer 2009

For specific training information, please visit <http://redesign.rcu.msstate.edu>.

- Teachers will receive training related to new curriculum content.
- An assessment meeting will be conducted during or after curriculum training sessions.
- Teachers will be required to complete all licensure requirements within 3 years of obtaining new endorsement.

Writing Team Members

Trey Gore, Pearl Rankin Career and Technical Center, Pearl, MS

Angie Herrington, Madison Career and Technical Center, Madison, MS

Hattie Opara-Nadi, Siwell Road Middle School, Jackson, MS

Sherrie Powell, Calhoun County Career and Technical Center, Calhoun City, MS

Kimberly Rucker, Claiborne County Vocational and Technical Center, Port Gibson, MS

Steve Shaw, Alcorn Career and Technology Center, Corinth, MS

Christye Vanhorn, Winona Vocational Center, Winona, MS

Course Outlines

This curriculum framework allows multiple options for local school districts to implement based on the local needs of industry and students. The first option groups units into a 2-year, four-Carnegie-unit program. The second option groups units into a one-credit Graphics and Print course, followed by a two-Carnegie-unit Web Design and Video Production course, followed by a one-Carnegie-unit option for students that may include an internship or co-op program or comprehensive project. The third option groups units into four one-Carnegie-unit courses. An in-depth discussion of each option is listed below.

The 1st year of Digital Media Technology introduces students to the principles and skills associated with graphic and print production as it is related to meeting the needs of clients and producing graphic design products. The 2nd year of the program concentrates on video production and an applicable field experience or directed individual project.

Digital Media Technology I

Unit	Title	Hours
1	Introduction, Safety, and Orientation	10
2	Ethical Content and Production	20
3	Photography	25
4	Graphic Design and Print Production	85
		140

Digital Media Technology II

Unit	Title	Hours
1	Introduction to Web Design	30
2	Building a Basic Client Web Site	40
3	Media Rich Content for Web Design	35
4	Planning a Digital Narrative and Creating a Script	35
		140

Digital Media Technology III

Unit	Title	Hours
1	Career Opportunities in Audio and Video Technology	10
2	Audio Production	35
3	Video Production	35
4	Production Systems	35
5	Production Process	25
		140

Digital Media Technology IV

Unit	Title	Hours
1	Communications	45
2	Problem Solving and Critical Thinking	45
3	DMT Seminar and Experience	50
		140

Digital Media Technology I

1. Identify course expectations, school policies, program policies, and safety procedures related to Digital Media Technology (DMT).
 - a. Identify course expectations, school policies, and program policies related to Digital Media Technology.
 - b. Apply safety procedures in the computer classroom and lab.
2. Explore personality development, leadership, and teamwork in relation to the classroom environment, interpersonal skills, and others.
 - a. Identify potential influences that shape the personality development including personality traits, heredity, and environment.
 - b. Develop a report on how personality traits affect teamwork and leadership skills.
 - c. Identify forces that shape personality development including personality traits, heredity, and environment.
 - d. Develop effective leadership, decision-making, and communication skills.
3. Research copyright rules, regulations, and issues related to graphics and images produced by others and original work, and adhere to those rules and regulations when developing work.
 - a. Define terms related to copyright rules, regulations, and issues related to graphics and images produced by others and original work.
 - b. Research copyright laws related to graphics, images, and other original work.
 - c. Give examples of copyright violations related to trademark, symbols, length of time, and public domain.
 - d. Prepare images and video for Web and print that meet copyright guidelines.
4. Research online content, and evaluate content bias, currency, and source.
 - a. Determine how to search for information online.
 - b. Correlate information with multiple sources.
5. Define and abide by the journalistic code of ethics.
 - a. Define terms related to the journalistic code of ethics.
 - b. Identify the similarities and differences between news and advertisement.
 - c. Compare and contrast news and opinions, and determine the benefits and dangers of reporting non-biased information.
 - d. Demonstrate the ability to avoid conflicts of interest, bribery, and knowledge of personal political and economic interests.
 - e. Maintain confidentiality of sources, and avoid anonymous sources when possible.
 - f. Demonstrate proper use of pictures, sounds bites, and quotations.
 - g. Discuss plagiarism and the consequences of plagiarizing.
 - h. Demonstrate standards for factual reporting.
 - i. Demonstrate an understanding of libel and slander, privacy rights, and a publisher's obligation to defend a reporter against any libel suit filed against him or her.
 - j. Describe the principle of harm limitation.
6. Create and edit a written document in a technical environment.
 - a. Apply components of proper grammar, punctuation, and speech.
 - b. List the steps in creating and editing a technical document.
 - c. Create a technical writing document utilizing the four phases of the technical writing process.

7. Demonstrate proficiency in the setup, operation, and troubleshooting of a graphic design computer.
 - a. Demonstrate proficiency in the setup and maintenance of a graphic computer system.
 - b. Manipulate a window by using application software functions and keyboard shortcuts.
 - c. Demonstrate knowledge of an electronic file management system and folder management.
8. Explain photography and graphic design elements.
 - a. Identify safety and proper use of equipment related to photography.
 - b. Identify the basic components of a digital camera and photography-related terms.
9. Complete a photography project that meets the needs of an audience.
 - a. Explore image composition and elements of visual design through photography.
 - b. Distinguish file type per job needed.
 - c. Use digital cameras to learn the basics of photography.
 - d. Identify and produce portrait photographs, art photographs (objects in the classroom), and landscape photographs.
 - e. Use photo manipulation to investigate the potential of color enhancement and retouching.
 - f. Compare and contrast the advantages of manipulating a saved copy of an image in various formats.
10. Use photo editing software to create and edit a product for a customer.
 - a. Identify terminology related to the photo editing software.
 - b. Demonstrate how to open and save an image from a digital camera and an image from a scanner in photo editing software.
 - c. Apply the following tools of photo editing software.
 - Histogram
 - Levels
 - Curves
 - Brightness
 - Auto color correction
 - Clone stamp
 - Lasso
 - Magic wand
 - Crop
 - Image
 - Canvas size
 - Transform
 - d. Determine proper resolution for printing an 8-in. by 10-in. photograph on the designated size of paper using photo editing software.
 - e. Use Photomerge to create panoramic images.
11. Apply color theory and design principles.
 - a. Discuss the types of design principles, and have students define design principle terms.
 - b. Understand the importance of color management, and explain why color variations occur between devices.
 - c. Demonstrate use of selection, drawing, and painting tools in appropriate graphic design software.
 - d. Discuss possible canvas sizes for logos, and demonstrate the options that can be altered.
 - e. Understand and incorporate image-optimization (vector and bitmap) strategies and file formats.

- f. Identify aspects of redesign and its importance in the design process.
12. Understand typography and layout design.
 - a. Understand typography concepts for use in planning and designing in graphic design.
 - b. Discuss how tone, audience, and purpose impact design and readability.
 - c. Explore resizing and cropping images.
 - d. Demonstrate layout in graphic software (InDesign).
 - e. Demonstrate importing files into graphic software.
13. Apply design principles and techniques in the creation of an advertisement.
 - a. Understand design principles and techniques for use in planning, designing, and producing an advertisement.
 - b. Introduce aspects of project management and how to work with clients.
 - c. Plan and design an advertisement.
 - d. Build an advertisement.
 - e. Understand the process of reviewing and redesigning an advertisement.
14. Utilize advanced image manipulation and page layout to create a brochure.
 - a. Demonstrate advanced image manipulation techniques.
 - b. Demonstrate advanced layout techniques.
15. Create a newsletter layout with advanced editing.
 - a. Identify standard newsletter publishing practices, and cite sources.
 - b. Examine newsletters to identify the following elements:
 - Nameplate
 - Content (and number of articles or entries)
 - Table of contents
 - Masthead
 - Titles and headers
 - Page numbers
 - Bylines
 - Continuation lines
 - Pull quotes
 - End signs
 - Photos/illustrations
 - Mailing panels
 - c. Discuss the concept of working as a team and roles in newsletter production.
 - d. Design, build, and review a newsletter.
 - e. Present the finished newsletter to an audience.
16. Research careers, and develop a professional portfolio.
 - a. Research career areas in design and/or print production.
 - b. Identify the purpose of a portfolio as it relates to career planning.
 - c. Construct a portfolio.
 - d. Present a portfolio.

Digital Media Technology II

1. Identify the components of Web design application software.
 - a. Research key vocabulary terms, and illustrate terminology used with Web design applications.
 - b. Identify the basic components of a Web design application screen.
 - c. Research certification requirements for a Web specialist.
 - d. Identify the elements of the graphic design software interface.
 - e. Demonstrate knowledge of best practices for designing a Web site, such as maintaining consistency, separating content from design, and using standard fonts and Web-safe fonts.
 - f. Demonstrate knowledge of page layout design elements and principles, and organize content consistently.
2. Demonstrate skills needed for planning and creating a home page.
 - a. Research key vocabulary terms related to planning and creating a home page.
 - b. Plan and create a detailed storyboard for the home page of a portfolio.
 - c. Incorporate principles of good user interface design on a home page.
3. Demonstrate knowledge of best practices for designing Web sites, such as maintaining consistency, separating content from design, and using standard fonts and Web-safe colors.
 - a. Research key vocabulary terms, and illustrate terminology used with creating content pages.
 - b. Demonstrate knowledge of designing a Web site.
 - c. Make design decisions such as colors, layout, and structuring navigation through Web sites.
4. Demonstrate proficiency linking Web content using hyperlinks, e-mail links, and named anchors.
 - a. Identify key vocabulary terms related to linking pages.
 - b. Demonstrate adding links using the Properties pane.
 - c. Create links using the Hyperlink dialog box.
 - d. Demonstrate three methods for using the property inspector to create links from text or an image to another document.
5. Demonstrate knowledge of Web site accessibility standards that address the needs of people with visual and motor impairments.
 - a. Identify terminology and techniques associated with ensuring usability and accessibility.
 - b. Demonstrate the ability to use visual clues about navigation, structure, and organization.
 - c. Demonstrate text-formatting guidelines that improve Web site readability.
6. Demonstrate how to insert a graphical navigation bar created in a separate program.
 - a. Identify terminology and techniques associated with ensuring usability and accessibility.
 - b. Demonstrate how to create three-state buttons and how to set the active area for a button using a multimedia authoring program.
 - c. Demonstrate how to export a navigation bar from a different application.
 - d. Demonstrate how to use roundtrip editing to edit images with different software.
7. Produce Web site designs that work equally well on various operating systems and browser versions.
 - a. Identify terminology and techniques associated with ensuring quality assurance.
 - b. Conduct a quality assurance test on the students' electronic portfolios.

- c. Demonstrate how to conduct a technical and functional usability test.
8. Identify techniques and methods for basic usability tests and collecting site feedback.
 - a. Identify terminology and techniques associated with ensuring usability and accessibility.
 - b. Demonstrate methods for collecting site visitor feedback and site evaluation information.
 - c. Identify characteristics of what a usability observation looks for.
9. Demonstrate knowledge of using and managing assets, links, and files to publish and update site files to a remote server.
 - a. Identify key terminology and techniques associated with publishing a Web site.
 - b. Demonstrate how to set up a remote site.
 - c. Demonstrate how to use the Web browser to open newly published sites.
 - d. Identify how to navigate each page to ensure all files were successfully published and are valid and reliable.
10. Use basic HTML tags to set up an HTML document, format text, add links, create tables, and build ordered and unordered lists.
 - a. Identify terminology and techniques associated with Hyper Text Markup Language (HTML).
 - b. Demonstrate how to locate the code view and create tags using the Web browser.
11. Gather information and data as it pertains to the development of a client Web site.
 - a. Define the scope of the project and related terms.
 - b. Identify the phases of a client Web site project to build a common class understanding and agreement for each phase and task (i.e., goals, target audience, content, and delivery requirements for the Web site).
 - c. Interview clients to identify the goals and audience, the design and technical (delivery) requirements, and the main content.
 - d. Write a brief design document incorporating information from clients.
12. Utilize the phases involved in planning a client Web site in order to effectively meet the client's needs.
 - a. Discuss the project phases again in the context of the client Web sites.
 - b. Define a project plan for a client Web site project.
13. Use an effective and functional structure in creating a client Web site.
 - a. Build a flowchart for the client site (screen view, flowchart, and information organization).
 - b. Present the flowchart to the client.
 - c. Create screen views of the home page and sample content page for the client site.
14. Apply techniques of design to create a suitable client Web site.
 - a. Create design comps of a home page and a sample content page to show different looks.
15. Utilize client feedback to improve a design concept.
 - a. Define the terms *active listening* and *production storyboard*.
 - b. Use active listening skills during the client review.
 - c. Revise design comps, and present revised design comps to the client.
 - d. Create production storyboards for a client Web site.
16. Utilize cascading style sheets to ensure consistency of style and theme.
 - a. Define key terms related to cascading style sheets.
 - b. Create a style sheet for use with the client Web site.
17. Develop a final product for the client utilizing all design phases, feedback, and peer collaboration.

Executive Summary

- a. Work collaboratively to build a client Web site.
 - b. Use templates and libraries to build consistent Web pages.
 - c. Apply cascading style sheets to templates.
 - d. Discuss and demonstrate library features as they relate to templates.
 - e. Create a Web site using templates.
18. Test the Web site for usability and accessibility.
- a. Conduct a technical test on a client Web site, and compile a bug list.
 - b. Conduct a usability test on a client Web site.
 - c. Compile the results of technical testing and usability testing of a client Web site, make necessary revisions, and add the client site to an electronic portfolio.
19. Compose a marketing plan to publicize the client Web site.
- a. Create a basic marketing plan for the client Web site.
 - b. Present a Web site and marketing plan to the client.
20. Apply media rich concepts in order to enhance a Web site.
- a. Identify parts of a rich media software program workspace, including the following (DOK 1):
 - Timeline
 - Frames
 - Layers
 - The stage
 - Scenes
 - Tools
 - Panels
 - Property inspector
 - Symbols
 - Instances
 - Libraries
 - b. Create an interactive animated movie that incorporates motion and shape tweens, sound, and buttons.
21. Examine the properties and benefits of Adobe Flash software.
- a. Identify the use of technical elements such as tweens, images, text animations, actions, and sound in Adobe Flash CS3 movies and ads on the Web.
22. Incorporate video and multimedia elements into Web design.
- a. Examine Web sites that incorporate Flash video.
 - b. Appropriately incorporate video in a Flash document for use on a Web site.
 - c. Identify challenges with using video on the Web and the ways in which Flash video addresses these challenges and improves user experience.
23. Utilize motion tweens to enhance the user experience.
- a. Examine Web sites that use masking and path animation techniques.
 - b. Build mask effects and path animations involving advanced motion tweens.
 - c. Identify how masking and path animations can be used to enhance user experience on the Web.
24. Utilize effects and film techniques to make a story more effective.
- a. Examine online examples that use various Adobe Flash CS3 techniques.
 - b. Work with custom colors and gradients in Flash.
 - c. Develop transition effects built through motion, shape, and text tweening in preparation for enhancing a narrative.
 - d. Build filmmaking effects involving advanced motion and shape tweens.

25. Compose a digital narrative and script in order to effectively communicate through multimedia.
 - a. Plan and design a narrative to effectively communicate a message.
 - b. Write a script for a digital narrative.
 - c. Peer critique narrative scripts, considering audience and time frame.
26. Design an animation storyboard in order to plan and organize a digital narrative.
 - a. Create an animation storyboard.
 - b. Develop techniques for an effective animation storyboard.
27. Produce a digital narrative from a peer-created storyboard.
 - a. Import optimized images and self-recorded audio into Adobe Flash CS3.
 - b. Produce a digital narrative from a flowchart and animation storyboard.
28. Prepare a digital narrative for publishing by collecting feedback and editing accordingly.
 - a. Conduct a peer review of a digital narrative.
 - b. Incorporate peer-suggested changes into a digital narrative.
 - c. Publish a digital narrative as an HTML document.

Digital Media Technology III

1. Explain the history of film.
 - a. Discuss the beginnings and evolution of audio and video production and film.
2. Analyze various careers and their job descriptions in audio and video technology and film.
 - a. Discuss the responsibilities of producers, including budgets, schedules, personnel, and tracking progress.
 - b. Describe the responsibilities of directors, including knowledge of story structure, script analysis, the relationship to the production team, and the responsibilities of crewmembers.
 - c. Describe the duties of editors for audio, video, and film productions.
 - d. Discuss the duties of editors related to audio and visual effects.
 - e. Describe various jobs associated with animation, including communications, video, and feature-length productions and Internet streaming.
 - f. Discuss the responsibilities of others in this field, including lighting directors, cinematographers, videographers, sound engineers, stunt coordinators, special effects coordinators, production specialists, and other crewmembers.
3. Define the terminology associated with audio and video technology and film production.
 - a. Define commonly used audio production terminology.
 - b. Define commonly used video production terminology.
4. Explain the value of having a broad general knowledge of fine arts and cultural and regional diversity.
 - a. Identify various types of audio and visual approaches that convey information or create an emotional impact.
 - b. Explain how knowledge is useful in dealing with projects covering a broad spectrum of events, regions, or cultures when research may not be possible.
5. Describe the types of microphones, pickup patterns, and techniques required for a variety of audio presentations.
 - a. Identify microphones used for audio–video productions, music, and theater.
 - b. Explain why audio pickup differs in various types of microphones.
6. Employ knowledge regarding audio equipment used for productions including basic recording equipment, equalizers, mixing consoles, and quality-monitoring equipment.
 - a. Identify basic recording session equipment.
 - b. Select equipment required for specific types of audio productions.
 - c. Describe how an audio mixing console, quality-monitoring equipment, and basic recording session equipment are utilized.
 - d. Demonstrate techniques used for equalization.
 - e. Demonstrate how to record and mix audio.
7. Explain features and uses of analog and digital audio formats.
 - a. Explain features and uses of analog and digital audio formats.
 - b. Describe the difference in data signals and equipment for analog and digital technology.

8. Illustrate the techniques required for synchronization of an audio with video and multiple sound tracks.
 - a. Describe synchronization processes.
 - b. Demonstrate how audio is synchronized with other audio or video.
9. Write audio scripts for various types of programs.
 - a. Identify the key elements required in audio scripts.
 - b. Explain how various styles of music can create a specific emotional impact.
 - c. Apply writing skills to the development of a short audio script.
10. Apply knowledge of lighting requirements to a planned production.
 - a. Identify types and placement of lighting fixtures for various lighting effects.
 - b. Demonstrate lighting techniques used for portable and studio productions.
 - c. Demonstrate operation of a master lighting panel and dimmer panel board.
11. Demonstrate operation of video systems.
 - a. Describe the Beta SP 1/2-in. operating system.
 - b. Describe Mini DV, non-linear memory devices, and HDTV.
 - c. Demonstrate operation of video cameras and switchers.
 - d. Demonstrate how to clean, tune, and align video equipment.
12. Demonstrate video system maintenance procedures.
13. Demonstrate camera operations and video signals.
 - a. Describe how to frame and maintain picture composition.
 - b. Demonstrate focusing and adjusting images and performing pans and zooms.
 - c. Interpret video signals and production formats.
14. Employ knowledge of computer-based development in video production and editing, with an emphasis on digital technology.
 - a. Define terms associated with computer-based production, including motion video (AVI, QuickTime, and MPEG) and stills (JPEG and TIFF).
 - b. Identify types of software used in the development of video files and animations.
 - c. Demonstrate how to use software for developing a simple video.
 - d. Demonstrate using software to edit a video.
15. Identify the basic functions and resources for editing.
 - a. Define editing related to audio and video productions.
 - b. Describe the differences between offline and online editing related to low- and high-resolution input, respectively.
 - c. Identify editing skills related to various delivery requirements, including commercial broadcast and other forms of distribution.
 - d. Describe the significance of digital technology and high-definition production and the required equipment related to editing.
16. Apply knowledge of basic editing to both linear and nonlinear systems.
 - a. Describe linear and nonlinear systems.
 - b. Demonstrate skills required for editing using these systems.
17. Employ knowledge of control peripherals used for editing.
 - a. Describe various digital platforms such as high definition, DVC Pro, and Digital Beta.

18. Apply knowledge of the critical elements in designing a production to activities in the pre-production stage.
 - a. Create a short script, and identify the resources needed to begin the production.
 - b. Identify the activities associated with pre-production, production, and postproduction.
 - c. Analyze the script and storyboard development processes for a successful production.
 - d. Identify the linkage from each stage to the next in processes and activities.
 - e. Identify the team roles required for completion of a production.
 - f. Identify equipment, crew, and cast requirements for a short, scripted audio–video.
 - g. Identify several means to work within budget restraints.
 - h. Conduct a casting day for the script.
 - i. Execute production of the script.
 - j. Critique a production to determine how the various elements resulted in a successful or unsuccessful presentation.
 - k. Provide production support for audio, video, and film presentations.
19. Demonstrate repairing and servicing transmitting and receiving systems.
 - a. Describe the need for temperature stability.
 - b. Describe the connection between receiver sensitivity and measurement of image rejection.
 - c. Demonstrate how to align the receivers and transceivers for operation.
 - d. Demonstrate basic preventative maintenance.
20. Employ knowledge of wireless and wired transmission systems.
 - a. Define wireless system components.
 - b. Define wired system components.
 - c. Describe how to repair transmitting and receiving and multichannel systems.
21. Demonstrate installation of cabling for audio and video productions.
 - a. Demonstrate reading a signal flow diagram to determine cabling route.
 - b. Demonstrate pulling and securing cable.
 - c. Demonstrate how to document the routing.
22. Demonstrate the installation of a wireless audio–video system.
 - a. Identify how to determine if the power supply is adequate.
 - b. Demonstrate placement of a wireless audio system for efficient operation.
 - c. Describe a scenario that requires building support structures and tie-downs.
23. Demonstrate how to troubleshoot audio–video system operations.
 - a. Identify the sequence required for troubleshooting.
 - b. Conduct a troubleshooting sequence.
 - c. Identify problems and potential solutions.

Digital Media Technology IV

1. Select and employ appropriate reading and communication strategies to learn and use technical concepts in vocabulary practice.
 - a. Demonstrate use of content, technical concepts, and vocabulary when analyzing information and following directions.
 - b. Select the reading strategy or strategies needed to fully comprehend the content in a written document.
 - c. Interpret information, data, and observations to apply information learned from reading to actual practice.
 - d. Transcribe information, data, and observations to apply information learned from reading to actual practice.
 - e. Communicate information, data, and observations to apply information learned from reading to actual practice.
2. Demonstrate the concept, strategies, and systems for obtaining and conveying ideas and information to enhance communication in the workplace.
 - a. Employ verbal skills when obtaining and conveying information.
 - b. Record information needed to present and report a given topic or problem.
 - c. Write internal and external business correspondence that conveys and/or obtains information effectively.
 - d. Communicate with other employees to clarify work objectives.
 - e. Communicate effectively with customers and employees to foster positive relationships.
3. Locate, organize, and reference written information from various sources to communicate with co-workers and clients.
 - a. Locate written information used to communicate with co-workers and customers.
 - b. Organize information to use in written and oral communications.
 - c. Reference the source of information using APA format.
4. Use correct grammar, punctuation, and terminology to write and edit documents.
 - a. Compose multi-paragraph documents clearly, succinctly, and accurately.
 - b. Use descriptions of audience and purpose when preparing and editing written documents.
5. Develop and deliver formal and informal presentations using appropriate media to engage and inform audiences.
 - a. Prepare oral presentations to provide information for specific purposes and audiences.
 - b. Identify and prepare support materials that will enhance the oral presentation.
 - c. Develop and interpret tables, charts, and figures to support oral communication.
 - d. Deliver an oral presentation that sustains listeners' attention and interest.
6. Apply active listening skills to obtain and clarify information.
 - a. Interpret a given verbal message.
 - b. Respond with restatements and clarification techniques to clarify information.

7. Employ critical-thinking skills independently and in teams to solve problems and make decisions.
 - a. Use structured problem-solving methods when developing proposals and solutions.
8. Employ critical-thinking and interpersonal skills to resolve conflicts with staff and/or customers.
 - a. Analyze situations and behaviors that affect conflict management.
 - b. Resolve conflicts with/for customers using conflict resolution skills.
9. Identify, write, and monitor workplace performance goals to guide progress in assigned areas of responsibility and accountability.
 - a. Write realistic performance goals, objectives, and action plans.
 - b. Recognize goal achievement using appropriate rewards in the workplace.
10. Conduct technical research to gather information necessary for decision making.
 - a. Align the information gathered to the needs of an audience.
 - b. Gather technical information and data using a variety of resources.
 - c. Analyze information and data for value to the research objective.
 - d. Evaluate information and data to determine value to research objectives.
11. Explain written organization policies, rules, and procedures common to careers in arts, AV, technology, and communication fields.
 - a. Locate appropriate information on organizational policies and handbooks and manuals.
 - b. Discuss how specific organizational policies and rules influence a specific work situation.
12. Identify, examine, and select career opportunities in one or more arts, AV, technology, and communication related career pathways in order to explore career options.
 - a. Locate career opportunities that appeal to personal and career goals.
 - b. Match personal interests and aptitudes to selected careers.
13. Demonstrate the use of technical knowledge and skills that relate to career opportunities related to digital media technology to allow for mobility among numerous career options within the family of related occupations.
 - a. State how various career opportunities within the Digital Media Technology pathway work together to generate production, media, and other activities.
 - b. Identify pathways with common knowledge and skills that provide a worker with the potential for mobility.
14. Summarize new technological advancements and tools important to work in the digital media technology industry.
 - a. Analyze the technological systems that are apparent in the digital media technology work environment.
 - b. Research the impact of potential new technology advancements related to the digital media technology industry.

INSTALLATION AND SERVICE

Program Description Installation and Service

Program Description

The Installation and Service pathway, which consists of Industrial Maintenance and Heating, Ventilation, and Air-Conditioning, is an instructional program that prepares students for employment or continued education in the occupations of industrial maintenance technology and heating, ventilation, and air-conditioning. The curriculum framework for this program was developed in partnership with the Mississippi Construction Education Foundation (MCEF). MCEF is the accredited sponsor for the National Center for Construction Education and Research (NCCER).

Industry Certification

The NCCER developed and published a set of industry standards that are taught nationwide by contractors, associations, construction users, and secondary and postsecondary schools called the **Contren Learning Series**. When developing this set of standards, the NCCER assembled a team of subject matter experts that represented construction companies and schools across the nation. Each committee met several times and combined experts' knowledge and experience to finalize the set of national industry standards.

As a part of the accreditation process, all Mississippi Construction Technology instructors will be required to successfully complete the **Instructor Certification Training Program**. This program ensures that instructors possess a deep knowledge of content of the standards.

This state-of-the-art curriculum is modeled after the eight Mississippi **NCCER Accredited Training and Education Facilities (ATEF)**. In order to become an NCCER ATEF program, school districts must meet a set of guidelines including the following:

1. Use the approved curriculum.
2. All instructors must be NCCER certified.
3. All completed Form 200s and release forms on all student completions are to be forwarded to MCEF for proper approval. MCEF will in turn forward to NCCER for processing.
4. Follow NCCER guidelines on test security and performance profiles.
5. Have an active advisory committee with at least two commercial contractors involved.
6. Follow safety practices and Occupational Safety and Health Administration (OSHA) standards used in the class and lab areas.
7. Involve commercial contractors in class presentations or field trips.
8. All construction programs must be included in the accreditation process.
9. Show active involvement in student leadership development (e.g., VICA and SkillsUSA).
10. Provide demonstrated placement into construction-related occupations, and provide timely reports to MCEF.

Executive Summary

Districts will be required to complete a self-evaluation of all programs and host a site visit from industry to ensure proper lab, safety, and instructional procedures are in place.

Year 1 of Installation and Service is a basic course teaching fundamentals of safety, tools, math, blueprint reading, introduction to industrial maintenance technician, and introduction to heating, ventilation, and air-conditioning. Year 2 of the Installation and Service program consists of a local option content area chosen from Industrial Maintenance Technician or Heating, Ventilation, and Air-Conditioning. The option will prepare the student for employment in the content area chosen.

Articulation

The following articulation plan is in place for the Installation and Service Pathway.

Heating and Air-Conditioning	PS HVAC	ACT 1125 - Basic Compression Refrigeration
Industrial Maintenance Trades	PS Industrial Maintenance Trades	IMM 1213 - Industrial Hand Tools and Mechanical Components

Assessment

Students will be assessed using the Secondary Installation and Service MS-CPAS2 test. This exam will be administered after the second and fourth Carnegie unit is earned.

Student Prerequisites

In order for students to be able to experience success in the Installation and Service program, the following student prerequisites are in place:

1. C or Higher in English (the previous year)
2. C or Higher in Math (last course taken, or the instructor can specify the math)
or
3. Instructor Approval and TABE Reading Score (eighth grade or higher)
or
4. Instructor Approval

Applied Academic Credit

Applied math content from the curriculum was aligned to the 2007 Mississippi Math Framework Revised Academic Benchmarks. Upon the completion of this program, students will earn 1/2 Applied Math Credit that can be used for graduation requirements.

Licensure Requirements

The licensure ____ is needed to teach the Installation and Service program. The requirements for the licensure endorsement are listed below:

1. Applicants must hold a 2-year college degree (associate's degree) or higher from an accredited institution of higher education.
2. Applicants with an associate's degree must have at least 2 years of verifiable occupational experience in the past 10 years. Experience must be appropriate to the subject to be taught.

3. Applicants with a bachelor's or higher degree must have at least 1 year of verifiable occupational experience in the past 10 years. Experience must be appropriate to the subject to be taught.
4. Applicants must validate occupational competency by either (a) holding a valid certificate in the State of Mississippi and/or nationally as a result of successfully completing an assessment recognized and approved by MDE in the discipline in which the applicant is applying to teach or (b) earning required scores on an occupational competency assessment approved by MDE.
5. Applicants who hold a bachelor's or higher degree in the subject area to be taught is exempt from occupational competency testing.
6. Applicants must successfully complete the Vocational Instructor Preparation (VIP) program.
7. Applicants must successfully complete the Contren Instructor Certification.
8. Applicants must successfully complete an MDE-approved computer literacy certification exam.
9. Applicants must successfully complete certification for an online learning workshop, module, or course that is approved by the MDE.
10. Applicants must successfully complete the Construction Technology certification workshop, module, or course that is approved by the MDE.

Note: If the applicant meets all requirements listed above, that applicant will be issued a ____ endorsement—a 5-year license. If the applicant does not meet **all** requirements, the applicant will be issued a 3-year endorsement (license), and all requirements stated above must be satisfied prior to the ending date of that license.

Professional Learning

Information Technology Professional Learning Plan for Summer 2009

For specific training information, please visit <http://redesign.rcu.msstate.edu>.

- Teachers will receive training related to new curriculum content.
- An assessment meeting will be conducted during or after curriculum training sessions.
- Teachers will be required to complete all licensure requirements within 3 years of obtaining new endorsement.

Writing Team Members

Johnny Browder, Hinds County Career Center, Raymond
Lee Dell Buck, Claiborne County Vocational Center, Port Gibson
Eddie Jackson, Pontotoc Ridge Career and Technical Center, New Albany
Ralph James, Laurel High School Vocational Center, Laurel
Dennis Pounds, Carl Lofton Vocational Complex, Foxworth
Jacob Green, Pascagoula Applied Technology Center, Pascagoula
David Grant, Mississippi Delta Community College, Moorhead
Kenny Jobe, Mississippi Delta Community College, Moorhead
Marvin Moak, Hinds Community College, Raymond

Course Outlines

Course Name: HVAC

Course CIP Code: 47.0201

Course Name: Industrial Maintenance

Course CIP Code: 47.0303

Option 1

This curriculum framework allows multiple options for local school districts to implement based on the local needs of industry and students. This curriculum offers a 2-year, four-Carnegie-unit program.

Installation and Service I is the 1st year of the program. Installation and Service I content in the 1st year includes orientation and leadership; basic safety; math, measuring tools, and instruments; blueprints; hand and power tools; introduction to industrial maintenance; and heating, ventilation, and air-conditioning. Safety is emphasized in each unit and every activity.

Installation and Service II Option 1 is a continuation with the emphasis on industrial maintenance. Topics include employability skills, safety, gaskets, packing, pumps, drivers, valves, lubrication, test equipment, material handling, national electrical code, conductor termination, hydraulics, and pneumatics. The course should be taken after the student has successfully passed Installation and Service I.

Installation and Service II Option 2 is a continuation with the emphasis on Heating, Ventilation, and Air-Conditioning. Topics include employability skills, safety, ferrous metal piping, introduction to cooling, introduction to heating, air distribution, leak detection evacuation recovery and charging, alternating current, and basic electronics. The course should be taken after the student has successfully passed Installation and Service I.

- First-year and second-year students are not to enroll in the same course at the same time.
- Safety will be reinforced and tested at the beginning of each course.
- Students must complete manufacturing trade courses with a score of 80/C or higher in class work to advance to the next level.

Installation and Service I (Course Code: _____)

Unit	Title	Hours
1	Orientation and Safety	45
2	Math, Introduction to Blueprints, and Hand and Power Tools	85
3	Orientation to the Trade, Tools of the Trade, Fasteners and Anchors, and Oxy-Fuel Cutting (IM)	60
4	Introduction to HVAC, Tools of the Trade (HVAC), Copper and Plastic Piping, Soldering and Brazing, and Basic Electricity (IM)	40
		230

Executive Summary

Installation and Service II OPTION 1 (Industrial Maintenance) (Course Code: _____)

Unit	Title	Hours
1	Orientation and Safety (Review and Reinforcement)	5
2	Gaskets and Packing, Pumps and Drivers, Introduction to Valves, and Lubrication	63
3	Related Construction Math, Construction Drawings, Introduction to Test Equipment, Material Handling and Rigging, and Mobile and Support Equipment	60
4	Introduction to the National Electrical Code, Electrical Theory, Conductor Terminations and Splices, and Hydraulic and Pneumatic Controls	85
		213

Installation and Service II OPTION 2 (HVAC) (Course Code: _____)

Unit	Title	Hours
1	Orientation and Safety (Review and Reinforcement)	5
2	Trade Math, Ferrous Metal Piping Practice, Introduction to Cooling, and Introduction to Heating	140
3	Air Distribution Systems, Leak Detection Evacuation Recovery and Charging, Alternating Current, and Basic Electronics	70
		215

Installation and Service Year 1

Course Name: Installation and Service Year 1

Course CIP Code: 47.0201-HVAC

Course CIP Code: 47.0303-Industrial Maintenance

1. Describe local program and vocational/career technical center policies and procedures.
 - a. Describe local program and vocational/career technical center policies and procedures.
2. Describe employment opportunities and responsibilities of the industrial and HVAC mechanic.
 - a. Describe employer expectations in the workplace.
3. Explore leadership skills and personal development opportunities provided for students by student organizations to include SkillsUSA.
 - a. Demonstrate effective team-building and leadership skills.
 - b. Demonstrate through practice appropriate work ethics.
4. Describe general safety rules for working in a shop/lab and industry.
 - a. Discuss safety issues and prevention associated with the installation and service shop area.
 - b. Explain fire safety and prevention.
5. Apply the four basic math skills with whole numbers, fractions, and percents.
 - a. Perform mathematic calculations relating to the installation and service trade.
6. Perform basic mathematical calculations related to industrial maintenance shop operations.
 - a. Use the metric system in industrial maintenance and HVAC applications.
 - b. Compute distances according to a drawn plan, and then calculate the amount of material for a given project.
7. Identify and perform functions using various measuring tools and instruments.
 - a. Read a rule and layout lines to the nearest 1/16 in.
8. Read, analyze, and design a blueprint.
 - a. Identify and interpret terms and symbols commonly used on blueprints.
9. Demonstrate the use and maintenance of various hand and power tools found in the industrial maintenance and HVAC trade.
 - a. Identify and discuss the proper safe use of common hand and power tools.
 - b. Select and demonstrate the use of tools, and explain the procedures for maintaining hand and power tools.
10. The student will research and distinguish job opportunities in the industrial maintenance field and then reflect upon the importance of the industrial maintenance mechanic's role in modern manufacturing and service industry.
 - a. Describe employment opportunities in the industrial maintenance profession.
11. Identify and use tools found in the industrial maintenance trade, describe how each is used, and discuss proper care and maintenance of the tools.
 - a. Illustrate the use of tools used in the industrial maintenance profession.
 - b. Identify and use common hand and power tools used in the industrial maintenance trade.
12. Identify various fasteners and anchors found in the industrial and HVAC trade, how to install and remove fasteners and anchors, and how to select the correct fastener or anchor for an application.
 - a. Identify and install threaded fasteners, non-threaded fasteners, and anchors.

- b. Identify various grades of bolt hardness.
- 13. Identify and describe the basic equipment, setup, and safety rules for proper use of equipment, and prepare base metal for oxy-fuel welding.
 - a. Identify and explain the use of oxy-fuel cutting equipment.
 - b. Demonstrate how to use an oxy-fuel torch.
 - c. Perform oxy-fuel cutting:
 - Straight line and square shapes
 - Piercing and slot cutting
 - Bevels
 - Washing
- 14. Identify and explain heating, ventilation, and air-conditioning systems, HVAC environmental law, and job opportunities that are available in the HVAC profession.
 - a. Explain the basic principles of heating, ventilation, and air-conditioning.
 - b. Describe what the Clean Air Act means to the HVAC trade.
 - c. Identify the types of schedules/drawings used in the HVAC trade.
- 15. Demonstrate the safe use and routine maintenance of hand and power tools used in the HVAC trade.
 - a. Demonstrate the safe use and maintenance of hand and power tools used in HVAC.
- 16. Identify and discuss the tools used in the piping trade, discuss the materials and methods of connecting piping systems, and perform copper and plastic piping tasks found in the industrial maintenance and HVAC environment.
 - a. Discuss and demonstrate how to use copper tubing in HVAC.
 - b. Discuss and demonstrate how to use plastic tubing in HVAC.
- 17. Prepare and solder copper piping systems in various industrial and HVAC applications and properly clean, install fittings, and braze piping (silver solder).
 - a. Solder copper pipe in HVAC.
 - b. Braze copper pipe in HVAC.
- 18. Identify electrical safety hazards, demonstrate safety around circuits and equipment, describe basic electricity laws, interpret electrical drawings and schematics, and demonstrate wiring basic electrical circuits.
 - a. Describe how voltage, current, resistance, and power are mathematically related.
 - b. Describe the difference between series and parallel circuits, and calculate loads in each.
 - c. Describe the purpose and operation of the various electrical components used in equipment.

Installation and Service Year 2 Option 1

Course Name: Installation and Service (Industrial Maintenance) Year 2 Option 1

Course CIP Code: 47.0303

1. Describe local program and vocational/career technical center policies and procedures.
 - a. Describe local program and vocational/career technical center policies and procedures.
2. Describe employment opportunities and responsibilities of the industrial and HVAC mechanic.
 - a. Describe employer expectations in the workplace.
3. Explore leadership skills and personal development opportunities provided for students by student organizations to include SkillsUSA.
 - a. Demonstrate effective team-building and leadership skills.
 - b. Demonstrate through practice appropriate work ethics.
4. Describe general safety rules for working in a shop/lab and industry.
 - a. Discuss safety issues and prevention associated with the installation and service shop area.
 - b. Explain fire safety and prevention in the workplace.
5. Identify different types of gasket and packing materials, list their applications, and install gaskets and packing.
 - a. Identify the various types and materials of gaskets.
 - b. Describe the use of O-rings in the installation and service trade.
 - c. Describe the uses and methods of packing in the installation and service trade.
6. Identify types of pumps and prime movers, and explain pressure differential between inlet and outlet of pumps.
 - a. Identify and explain centrifugal, rotary, reciprocating, metering, and vacuum pumps.
 - b. Explain net positive suction head and cavitation.
 - c. Identify types of drivers.
7. Identify types of valves, and explain how to store and properly install valves.
 - a. Identify types of valves that start, stop, regulate, relieve pressure, and regulate direction of flow.
 - b. Explain how to properly store, handle, and mount valves in various locations and positions.
8. Describe and explain lubricant classification, additives, uses, and environments regulation regarding disposal of oils and greases.
 - a. Explain regulatory law regarding industrial lubricants.
 - b. Explain how lubricants protect mechanical machinery.
 - c. Explain the properties and handling of lubricants and grease.
9. Identify and explain measuring devices, solve geometric mathematical problems, and use weights and measurement standards.
 - a. Discuss mathematics used in the installation and services industry.
10. Identify components of the blueprint and scales, and perform projects from blueprints.
 - a. Read and draw a basic blueprint found in the installation and service area.
11. Identify and explain the use of various test equipment used in the trade, differentiate between analog and digital meter readouts, and properly test circuits and mechanisms using available school metering devices.
 - a. Explain the operation of the following pieces of test equipment:

- Tachometer
 - Pyrometers
 - Multimeters
 - Automated diagnostics tools
 - Wiggy voltage tester
 - Stroboscope
 - Frequency meter
- b. Explain how to read and convert from one scale to another using the above test equipment.
12. Identify and explain safe rigging practices, load distribution, hand signals, and rigging equipment.
- a. Identify, describe the uses of, inspect, and maintain common rigging hardware and equipment, including the following:
- Jacks
 - Block and tackle
 - Chain hoists
 - Come-alongs
- b. Tie knots used in rigging.
- c. Identify basic rigging and crane safety procedures, and use the correct hand signals to guide a crane operator.
13. Recognize types of mobile and support equipment found in the trade, explain the application for each device, and safely use equipment.
- a. State and explain the safety precautions, operation, and application associated with the use of motor-driven equipment commonly used in industrial plants, such as the following:
- Portable generators
 - Air compressors
 - Aerial lifts
 - Forklifts
 - Mobile cranes
- b. Operate and perform preventive maintenance on the following equipment:
- Portable generators
 - Air compressors
 - Aerial lifts
14. Identify types of conduit and sizes, bend various radiuses, and properly install conduit according to National Electrical Code (NEC).
- a. Identify the methods for hand bending and installing conduit.
15. Describe the purpose of the NEC, reference NEC code, and explain current applications of the NEC.
- a. Explain the purpose and history of the NEC.
- b. Use the NEC to reference industrial applications.
- c. Explain the role of nationally recognized testing laboratories.
16. Describe the units of measure of electricity and the types of circuits, define Ohm's and Kirchhoff's laws, and troubleshoot a simple circuit.
- a. Discuss the properties and physical laws of electricity.
- b. Identify the meters used to measure voltage, current, and resistance.
- c. Discuss the properties of a series and parallel circuit.

17. Identify and make connections using various types of conductors, types of fastening devices, and NEC requirements for terminations and splices.
 - a. Describe how to make a conductor termination.
 - b. Prepare cable ends for terminations and splices, and connect the ends using lugs or connectors.
 - c. Train cable at termination points.
 - d. Describe the NEC requirements for making cable terminations and splices.
18. Identify and make connections using various types of conductors, types of fastening devices, and NEC requirements for terminations and splices.
 - a. Discuss the principles of industrial hydraulics.
 - b. Discuss the principles of industrial pneumatics.

Installation and Service Year 2 Option 2

Course Name: Installation and Service (HVAC) Year 2 Option 2

Course CIP Code: 47.0201

1. Describe local program and vocational/career technical center policies and procedures.
 - a. Describe local program and vocational/career technical center policies and procedures.
2. Describe employment opportunities and responsibilities of the industrial and HVAC mechanic.
 - a. Describe employer expectations in the workplace.
3. Explore leadership skills and personal development opportunities provided for students by student organizations to include SkillsUSA.
 - a. Demonstrate effective team-building and leadership skills.
 - b. Demonstrate through practice appropriate work ethics.
4. Describe general safety rules for working in a shop/lab and industry.
 - a. Discuss safety issues and prevention associated with the installation and service shop area.
 - b. Explain fire safety and prevention in the workplace.
5. Identify proper math to use for problem solving; use English and metric measurement; use powers, algebra, and geometric calculation to solve for HVAC problems; and convert Fahrenheit to Celsius.
 - a. Demonstrate how to calculate mathematic problems found in the HVAC area.
6. Recognize types and sizes of ferrous metal piping and pipe fittings, and also recognize and use tools used to cut, ream, and thread ferrous pipe in the HVAC application.
 - a. Explain the uses of ferrous metal pipes in the HVAC trade.
7. Explain the basic theory of cooling systems, heat transfer, trade terms, refrigerants, components of the cooling system, controls, and proper piping of the cooling system.
 - a. Explain how an HVAC system removes heat from an air-conditioned area of an HVAC system.
 - b. Identify the major components, accessories, and control devices available for cooling systems, and explain how each works.
8. Explain methods of heat transfer and characteristics of combustion, identify types of fuels and types of furnaces and components of the electric and gas furnace, identify and safely use meters in gas measurement, and perform maintenance on electric and gas furnaces.
 - a. Explain how an HVAC heating system operates.
 - b. Describe how an electric furnace works.
 - c. With supervision, perform basic furnace preventive maintenance procedures such as cleaning and filter replacement.
9. The student will understand the general practices of designing and installing HVAC duct and piping systems.
 - a. Discuss and explain the patterns of air flow and pressures in an HVAC duct.
 - b. Identify types of duct systems, and explain where each is used in installation and service applications.
10. The student will identify leaks in an HVAC system and perform the proper steps to repair the leak, restoring the unit to operation.
 - a. Define and perform a leak test on an HVAC system.

- b. Use nitrogen to purge a system, and charge refrigerant into a system by the following methods:
 - Weight
 - Superheat
 - Subcooling
 - Charging pressure
- 11. Gain an understanding of the safe operation of electrical transformers, motors, and single- and three-phase HVAC devices.
 - a. Explain and demonstrate the safe operation of various types of transformers.
 - b. Describe the types of capacitors and motors found in the HVAC unit.
 - c. State and demonstrate the safety precautions that must be followed when working with electrical equipment and testing AC components, including capacitors, transformers, and motors.
- 12. Explain and apply basic electrical theory to HVAC applications and how to troubleshoot common electronic devices found in HVAC systems
 - a. Explain basic electronic theory of semiconductors, and test the operation of various semiconductor devices such as resistors, diodes, LEDs, thermistors, cad cells, and photo diodes. Explain how these devices are used in power and control circuits.

INFORMATION TECHNOLOGY

Program Description Information Technology

Program Description

The Information Technology program is designed to provide the basic foundation, skills, and knowledge for computer networking, applications, and support, along with an introduction to programming. Students will receive the skills necessary to prepare for certification exams and will learn how to develop, support, and integrate computing systems; acquire network planning and management skills; and provide technical support. The program will provide hands-on experience in computer systems support and skill in network setup and maintenance. Industry standards referenced are from the *Skill Standards for Information Technology* published by the National Workforce Center for Emerging Technologies. Program competencies are designed to prepare students for A+ certification. Additional research data used in the development of this publication were collected from a review of related literature and from surveys of local experts in business, industry, and education.

Industry Certification

Program competencies are designed to prepare students for A+ certification by integrating certification skills throughout the curriculum. *Skill Standards for Information Technology* is also referenced to assist in student preparation for IT careers.

Articulation

The Postsecondary CIST (Computer Networking; Computer Programming; Web Development Network Security Technology; Database Administration Technology) program is currently under development. Once this program is presented to the State Board of Education in January 2009, an articulation agreement will be in place.

Assessment

Students will be assessed using the Secondary Information Technology MS-CPAS2 test. This exam will be administered to students during the fourth Carnegie unit.

Student Prerequisites

In order for students to experience success in the Information Technology program, the following prerequisites are recommended:

- C or Higher in Pre-Algebra

- or

- TABE Math Computation and TABE Math Applied Score (eighth grade or higher)

- or

- Instructor Approval

Licensure Requirements

The ____ licensure is needed to teach the Information Technology program. The requirements for the ____ licensure endorsement are listed below.

1. Applicants must have an associate's or higher degree and must have at least 1 year of verifiable occupational experience in the past 10 years. Experience must be appropriate to the subject to be taught.
2. Applicants must possess and maintain A+ Certification.
3. Applicants must successfully complete the Vocational Instructor Preparation (VIP) program.
4. Applicants must successfully complete an MDE-approved computer literacy certification exam.
5. Applicants must successfully complete certification for an online learning workshop, module, or course that is approved by the MDE.
6. Applicants must successfully complete an information technology certification workshop, module, or course that is approved by the MDE.

Note: If an applicant meets all requirements listed above, that applicant will be issued a ____ endorsement—a 5-year license. If an applicant does not meet all requirements, the applicant will be issued a 3-year endorsement license, and all requirements stated above must be satisfied prior to the ending date of that license.

Professional Learning

Information Technology Professional Learning Plan for Summer 2009

For specific training information, please visit <http://redesign.rcu.msstate.edu>.

- Teachers will receive training related to new curriculum content.
- An assessment meeting will be conducted during or after curriculum training sessions.
- Teachers will be required to complete all licensure requirements within 3 years of obtaining new endorsement.

Writing Team Members

Brad Amacker, Petal High School, Petal, MS

Walt Littleton, Ross Collins Career and Technical Center, Meridian, MS

Tim Boutwell, Director of Technology, Meridian Public School District, Meridian, MS

Chris Ethridge, Network Administrator, Meridian Public School District, Meridian, MS

John Fera, Engineer, Peavey Electronics, Meridian, MS

Brenda Arnsdorff, Instructor, Meridian Community College, Meridian, MS

Joy Russell, Instructor, Meridian Community College, Meridian, MS

Deborah Taylor, Customer Experience Manager, Best Buy, Meridian, MS

Robert White, Network Technician/Wireless, Howard Technology Solutions, Ellisville MS

David Bennette, Network Technician/VOIP, Howard Technology Solutions, Ellisville MS

John Rector, Director of Technology, Petal School District, Petal, MS

Course Outlines

Option 1

This option consists of two courses that should be completed in the following sequence:

1. Information Technology I
2. Information Technology II

Information Technology I provides the foundation skills necessary for IT professionals including an introduction to computer hardware and operation systems; data communications; and computer assembly, configuration, and diagnostics. The program also provides an introduction to computer programming.

Information Technology II provides opportunities for students to develop advanced networking skills, Web design skills, and employability skills. This course should be taken only upon successful completion of Information Technology I.

Information Technology I (Two Carnegie Units)

Course Code: 992200

Unit	Title	Hours
1	Introduction to Information Technology	40
2	Introduction to Computer Hardware and Operating Systems	70
3	Basic Electricity and Data Communications	40
4	Computer Assembly, Configuration, and Diagnostics	55
5	Visual Basic	30
		235

Information Technology II (Two Carnegie Units)

Course Code: 992204

Unit	Title	Hours
1	Web Design	45
2	Network Concepts	40
3	Network Planning and Design	60
4	Network Security	40
5	Career Development	30
		215

Option 2

This option consists of four courses that should be completed in the following sequence:

1. Computer Fundamentals
2. Network Fundamentals
3. Programming and Web Design
4. Information Technology Internship

Information Technology I provides the foundation skills necessary for IT professionals including an introduction to computer hardware and operation systems; data communications; and computer assembly, configuration, and diagnostics.

Executive Summary

Information Technology II provides opportunities for students to develop advanced networking skills and employability skills. This course should be taken only upon successful completion of Information Technology I.

Information Technology III provides instruction in computer programming and Web design.

Applied Information Technology is a culminating course designed to provide students with an internship experience in the field of information technology. The internship experience will include seminars or online learning experiences in which students discuss issues encountered during the internship and apply skills gained in Information Technology I, II, and III.

Students who wish to enroll in Applied Information Technology must meet the following requirements:

- Score 80% or higher on the MS-CPAS2 assessment.
- Attendance rate of 92% or higher in Introduction to Information Technology I and II
- Successful completion of a grade, discipline, and work ethic reviewed by the instructor
- Obtain employment in an IT-related field suited for application of skills gained in the program.

Computer Fundamentals (One Carnegie Unit)

Course Code: 992201

Unit	Title	Hours
1	Introduction to Information Technology	25
2	Introduction to Computer Hardware and Operating Systems	45
3	Basic Electricity and Data Communications	35
4	Computer Assembly, Configuration, and Diagnostics	35
		140

Network Fundamentals (One Carnegie Unit)

Course Code: 992202

Unit	Title	Hours
1	Network Concepts	35
2	Network Planning and Design	50
3	Network Security	35
4	Career Development	20
		140

Programming and Web Design (One Carnegie Unit)

Course Code: 992203

Unit	Title	Hours
1	Visual Basic	70
2	Web Design	70
		140

Information Technology Internship (One Carnegie Unit)

Course Code: 992206

Students will complete an internship that includes 480 student clock/work hours.

Option 3

This option consists of three courses that should be completed in the following sequence:

1. Introduction to Information Technology
2. Information Technology II
3. Information Technology Internship

Introduction to Information Technology provides the foundation skills necessary for IT professionals including an introduction to computer hardware and operation systems; data communications; and computer assembly, configuration, and diagnostics. The program also provides an introduction to computer programming.

Information Technology II provides opportunities for students to develop advanced networking skills, Web design skills, and employability skills. This two-Carnegie-unit course should be taken only upon successful completion of Information Technology I.

Information Technology Internship is a culminating course designed to provide students with an internship experience in the field of information technology. The internship experience will include seminars or online learning experiences in which students discuss issues encountered during the internship and apply skills gained in Information Technology I and II.

Students who wish to enroll in Applied Information Technology must meet the following requirements:

- Score 80% or higher on the MS-CPAS2 assessment.
- Attendance rate of 92% or higher in Introduction to Information Technology I and II
- Successful completion of a grade, discipline, and work ethic reviewed by the instructor
- Obtain employment in an IT-related field suited for application of skills gained in the program.

Introduction to Information Technology (One Carnegie Unit)

Course Code: 992205

Unit	Title	Hours
1	Introduction to Information Technology	20
2	Introduction to Computer Hardware and Operating Systems	40
3	Basic Electricity and Data Communications	30
4	Computer Assembly, Configuration, and Diagnostics	30
5	Visual Basic	20
		140

Information Technology II (Two Carnegie Units)

Course Code: 992204

Unit	Title	Hours
1	Web Design	45

Executive Summary

2	Network Concepts	40
3	Network Planning and Design	60
4	Network Security	40
5	Career Development	30
		215

Information Technology Internship (One Carnegie Unit)

Course Code: 992206

Students will complete an internship that includes 480 student clock/work hours.

Information Technology Year 1

Program Name: Computer Technology/Computer Systems Technology

Program CIP Code: 15.1202

1. Research educational, occupational, and leadership opportunities in information technology.
 - a. Review student rules and regulations for the local school.
 - b. Compare and contrast local program policies, procedures, and expectations to industry policies, procedures, and expectations.
 - c. Identify and describe leadership opportunities available from student youth organizations in the school and community.
 - d. Preview the school technology acceptable use policy.
2. Identify, discuss, and apply safety procedures in the computer classroom and lab.
 - a. Discuss the proper classroom and personal safety procedures to include fire extinguishers, electrical, clothing, jewelry, eye protection, and so forth.
 - b. Care for and use computer hardware correctly.
 - c. Handle DVDs and CDs correctly.
 - d. Identify potential health hazards when working on computer equipment.
3. Publish and communicate with peers, experts, and other audiences using technology.
 - a. Research safety issues related to telecommunications and the Internet.
 - b. Develop personal safety guidelines that will be used when using telecommunications and the Internet.
 - c. Describe legal implications related to the computer industry to include software copyright issues, software licensing, and Internet ethics and policies.
 - d. Use browsers, search engines, and e-mail.
 - e. Post information to discussion boards, blogs, wikis, and so forth.
 - f. Join and participate in appropriate, supervised Listservs.
 - g. Use an appropriate, supervised chat room to communicate with peers, experts, and other approved audiences.
 - h. Evaluate Web page design techniques.
 - i. Research, create, and present a presentation/project on emerging technologies, practices, trends, and issues associated with information technology.
4. Evaluate and resolve computer hardware and software issues.
 - a. Identify and describe computer types, purposes, and functions.
 - b. Differentiate between hardware and software in a computer environment.
 - c. Identify various pieces of hardware and the function(s) performed by each.
 - d. Identify and describe the internal components of a computer.
 - e. Identify and describe system resources to include I/O, processing, memory, and storage.
 - f. Identify and describe the various peripheral components of a computer.
5. Install, configure, and troubleshoot an operating system.
 - a. Identify and describe the components of an operating system (input, processing, storage, and output).
 - b. Discuss the difference between network operating systems and individual PC operating systems.
 - c. Compare and contrast operating systems.

- d. Demonstrate OS installation using various methods including CD installation and downloading.
 - e. Perform OS configuration and troubleshooting procedures.
6. Investigate operating systems, programming languages, and application software.
 - a. Research programming languages.
 - b. Compare and contrast various programming languages.
 - c. Research application software.
 - d. Compare and contrast various software applications.
7. Discuss voltage and current, explain UPS requirements, and troubleshoot transmission media.
 - a. Implement electrical safety procedures.
 - b. Discuss Ohm's law and the power formula.
 - c. Examine alternating and direct current.
 - d. Determine power requirements for the UPS.
 - e. Describe the functions of the surge protector.
 - f. Explore transmission media to include optics, copper wire, wireless/remote access, connectors, and circuits.
8. Apply basic networking concepts.
 - a. Identify basic networking terminology.
 - b. Use networking capabilities of an operating system.
 - c. Apply Internet concepts and capabilities.
9. Discuss voltage and current, explain UPS requirements, and troubleshoot transmission media.
 - a. Build a computer, install additional components, and diagnose hardware problems.
 - b. Install, configure, and upgrade an operating system and diagnose OS software issues.
 - c. Install and configure application, Web browser, and virus protection software.
 - d. Perform preventive maintenance procedures for a hard drive.
 - e. Examine causes, treatment, and prevention of viruses, and implement appropriate virus solutions.
10. Discuss voltage and current, explain UPS requirements, and troubleshoot transmission media.
 - a. Describe the program development cycle to include input/output, processing, and storage.
 - b. Create, run, and debug an original program to input data, process data, and print a report.
 - c. Create programs that perform calculations using arithmetic operations to include addition, subtraction, multiplication, division, and exponentiation.
 - d. Create programs that include decision, selection, and iteration statements to include IF/THEN statements, Case statements, Do loops and For/Next loops.
 - e. Create programs that use array/table structures.

Information Technology Year 2

Program Name: Computer Technology/Computer Systems Technology

Program CIP Code: 15.1202

1. Use Web page design technologies, evaluate existing designs, and design and maintain a Web page.
 - a. Investigate trends and markup languages related to advanced Web page design.
 - b. Evaluate Web page designs.
 - c. Create a basic Web page using commonly used HTML tags.
 - d. Develop a Web page using Web-authoring software.
2. Examine network hardware and software.
 - a. Define terminology related to networks.
 - b. Identify hardware components needed to network two or more computers, such as a network interface card, various cables, hubs, switches, and servers.
 - c. Identify the various operating systems for networks such as Novell, Windows NT, Windows XP, Windows Vista, UNIX, Linux, and Mac OS.
3. Relate characteristics, theories, and components of networks.
 - a. Discuss examples of recognized network topologies.
 - b. Compare network topologies.
 - c. Discuss protocols.
 - d. Discuss network models (OSI vs. protocol-specific, i.e. TCP/IP, IPX/SPX).
4. Examine transmission media, and establish connections to transmit information.
 - a. Compare transmission media to include coax, twisted pair, fiber optics, and wireless.
 - b. Demonstrate cabling termination techniques.
 - c. Test and troubleshoot wired and wireless connections.
5. Outline the physical and logical aspects of a local area network (LAN), and then plan and construct a LAN.
 - a. Investigate appropriate topology and protocols for a local area network.
 - b. Identify hardware components of a LAN.
 - c. Identify software components of a LAN.
 - d. Examine network models.
 - e. Define classes of network addresses and subnetworks.
 - f. Examine routing tables.
 - g. Plan, design, construct, and test a LAN.
6. Discuss the physical and logical components and protocols used in a wide area network (WAN), and then plan and design a WAN.
 - a. Examine domains and service providers.
 - b. Identify hardware components of a WAN.
 - c. Discuss the logical components of and various protocols used in a WAN.
 - d. Plan and design a WAN, and present a proposal.
7. Investigate and implement fundamental security principles.
 - a. Identify, describe, and discuss hardware and software security to include hardware deconstruction, smart cards/biometrics, authentication technologies, malicious software protection, software firewalls, and file system security.
 - b. Investigate security software and common security breaches and vulnerabilities.

- c. Identify, describe, and discuss data and physical security to include wireless encryption, client configuration, and access points.
 - d. Identify, describe, and discuss data and physical security to include data access, encryption, backups, data migration, data removal, password management, and locking the workstation.
 - e. Explain the importance and process of incidence reporting.
 - f. Recognize and determine appropriate responses to social engineering situations.
 - g. Install, configure, upgrade, and optimize hardware, software, and data security.
 - h. Create user accounts and edit user properties according to best practices for assigning and modifying rights, password creation and expiration, and security groups.
8. Investigate and implement fundamental security principles.
- a. Investigate career opportunities and emerging technologies in information technology.
 - b. Search resources for a job opening in an IT career field.
 - c. Prepare, in an acceptable format, a cover letter, a resume, and a follow-up letter using word processing software.
 - d. Demonstrate appropriate job interview skills, including completing a job application.
9. Use appropriate communication skills and professional behavior when communicating with clients and co-workers.
- a. Practice appropriate communication skills including speaking clearly and concisely, using tact and discretion, avoiding jargon, asking pertinent questions, and exercising listening skills.
 - b. Practice appropriate professional behavior including maintaining a positive attitude and tone of voice, avoiding arguments or defensiveness, and respecting clients' privacy and property.
10. Research opportunities related to information technology, and participate in field experiences or simulations.
- a. Investigate educational opportunities related to information technology.
 - b. Describe national standards and certification/licensing procedures related to information technology.
 - c. Describe the role of trade organizations, associations, and unions related to information technology.
 - d. Participate in a school-to-careers activity (shadowing, mentoring, simulations, career fair, etc.).
 - e. Visit an industry/computer center, and analyze the hardware/software usage and needs, the educational training for personnel, the tasks performed by personnel, and the future outlook for those jobs.

Appendix A: 21st Century Skills Standards

CLS1	Flexibility and Adaptability
CLS2	Initiative and Self-Direction
CLS3	Social and Cross-Cultural Skills
CLS4	Productivity and Accountability
CLS5	Leadership and Responsibility

Today's life and work environments require far more than thinking skills and content knowledge. The ability to navigate the complex life and work environments in the globally competitive information age requires students to pay rigorous attention to developing adequate life and career skills.

CS 1 Flexibility and Adaptability

- Adapting to varied roles and responsibilities
- Working effectively in a climate of ambiguity and changing priorities

CS 2 Initiative and Self-Direction

- Monitoring one's own understanding and learning needs
- Going beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
- Demonstrating initiative to advance skill levels toward a professional level
- Defining, prioritizing, and completing tasks without direct oversight
- Utilizing time efficiently and managing workload
- Demonstrating commitment to learning as a lifelong process

CS 3 Social and Cross-Cultural Skills

- Working appropriately and productively with others
- Leveraging the collective intelligence of groups when appropriate
- Bridging cultural differences and using differing perspectives to increase innovation and the quality of work

CS 4 Productivity and Accountability

- Setting and meeting high standards and goals for delivering quality work on time
- Demonstrating diligence and a positive work ethic (e.g., being punctual and reliable)

CS 5 Leadership and Responsibility

- Using interpersonal and problem-solving skills to influence and guide others toward a goal
- Leveraging strengths of others to accomplish a common goal
- Demonstrating integrity and ethical behavior
- Acting responsibly with the interests of the larger community in mind

Appendix B: Mississippi Academic Standards

INTRODUCTION TO ENGINEERING

- IE1 Compute unit conversions, and illustrate graphical interpretations.
- IE2 Apply algebraic equations and functions to engineering situations.
- IE3 Apply geometric principles to engineering situations.
- IE4 Apply fundamental concepts of measurement such as time, distance, area, and volume with principles of engineering in a variety of contexts.
- IE5 Interpret charts, graphs, and other data obtained from actual or hypothetical engineering events and situations.

PHYSICS

- PHY1 Apply inquiry-based and problem-solving processes and skills to scientific investigations.
- PHY2 Develop an understanding of concepts related to forces and motion.
- PHY3 Develop an understanding of concepts related to work and energy.
- PHY4 Discuss the characteristics and properties of light and sound.
- PHY5 Apply an understanding of magnetism, electric fields, and electricity.
- PHY6 Analyze and explain concepts of nuclear physics.

PRE-ALGEBRA

- PRA1. Apply concepts and perform basic operations using real numbers in real-world contexts.
- PRA2. Apply properties to simplify algebraic expressions, solve linear equations and inequalities, and apply principles of graphing.
- PRA3. Identify and apply geometric principles to polygons, angles, and two- and three-dimensional figures.
- PRA4. Understand measurable attributes of objects and apply various formulas in problem solving situations.
- PRA5. Interpret, organize, and make predictions about a variety of data using concepts of probability.

SURVEY OF MATHEMATICAL TOPICS

- SMT1 Compute, analyze, and develop a variety of skills necessary to manage personal and business finance to include aspects of employer-employee decision making and consumer credit.
- SMT2 Identify and apply the practices that affect employer and employee decision-making.
- SMT3 Demonstrate an understanding of the impact of consumer credit.
- SMT4 Collect and apply information for planning a trip.
- SGM5. Organize and interpret data. Analyze data to make predictions.

TRANSITION TO ALGEBRA

- TTA1. Understand relationships between numbers and their properties, and perform operations fluently.

- TTA2. Understand, represent, and analyze patterns, relations, and functions.
- TTA3. Understand geometric principles of polygons, angles, and figures.
- TTA4. Demonstrate and apply various formulas in problem-solving situations.
- TTA5. Interpret data.

ALGEBRA I

- ALG1-1. Understand relationships between numbers and their properties, and perform operations fluently.
- ALG1-2. Understand, represent, and analyze patterns, relations, and functions.
- ALG1-3. Understand how algebra and geometric representations interconnect and build on one another.
- ALG1-4. Demonstrate and apply various formulas in problem-solving situations.
- ALG1-5. Represent, analyze, and make inferences based on data with and without the use of technology.

Computer Engineering I and II

- CE1 Demonstrate basic business meeting skills and goal setting.
- CE2 Demonstrate installing, configuring, and upgrading a system.
- CE3 Demonstrate diagnosing and troubleshooting a system.
- CE4 Demonstrate the various types of preventive maintenance measures, products, and procedures.
- CE5 Distinguish between the motherboard, processor, and memory components.
- CE6 Identify printer technologies, interfaces, and options/upgrades.
- CE7 Identify the common types of network cables, their characteristics, and connectors.
- CE8 Demonstrate communication, problem-solving, and team-building skills.
- CE9 Explain the operating system fundamentals.
- CE10 Demonstrate the installation, configuration, and upgrading of operating systems.
- CE11 Evaluate diagnosing and troubleshooting methods.
- CE12 Explore network designs.

Network Essentials

- NE 1 Demonstrate career planning and leadership skills.
- NE2 Explain components and functions of PC and network hardware.
- NE3 Analyze the evolution and capabilities of operating systems.
- NE4 Demonstrate the installation, configuration, and use of operating systems.
- NE5 Evaluate internetworking media and transmission methods.
- NE6 Analyze specific network architectures.
- NE7 Analyze protocol models.
- NE8 Explore various network designs.
- NE9 Analyze network planning and design.
- NE10 Explore the basics of network management and monitoring.

Appendix C: ACT College Readiness Standards

English

E1 Topic Development in Terms of Purpose and Focus

- Identify the basic purpose or role of a specified phrase or sentence.
- Delete a clause or sentence because it is obviously irrelevant to the essay.
- Identify the central idea or main topic of a straightforward piece of writing.
- Determine relevancy when presented with a variety of sentence-level details.
- Identify the focus of a simple essay, applying that knowledge to add a sentence that sharpens that focus or to determine if an essay has met a specified goal.
- Delete material primarily because it disturbs the flow and development of the paragraph.
- Add a sentence to accomplish a fairly straightforward purpose such as illustrating a given statement.
- Apply an awareness of the focus and purpose of a fairly involved essay to determine the rhetorical effect and suitability of an existing phrase or sentence or to determine the need to delete plausible but irrelevant material.
- Add a sentence to accomplish a subtle rhetorical purpose such as to emphasize, to add supporting detail, or to express meaning through connotation.
- Determine whether a complex essay has accomplished a specific purpose.
- Add a phrase or sentence to accomplish a complex purpose, often expressed in terms of the main focus of the essay.

E2 Organization, Unity, and Coherence

- Use conjunctive adverbs or phrases to show time relationship in simple narrative essays (e.g., *then*, *this time*, etc).
- Select the most logical place to add a sentence in a paragraph.
- Use conjunctive adverbs or phrases to express straightforward logical relationships (e.g., *first*, *afterward*, *in response*).
- Decide the most logical place to add a sentence in an essay.
- Add a sentence that introduces a simple paragraph.
- Determine the need for conjunctive adverbs or phrases to create subtle logical connections between sentences (e.g., *therefore*, *however*, *in addition*).
- Rearrange the sentences in a fairly uncomplicated paragraph for the sake of logic.
- Add a sentence to introduce or conclude the essay or to provide a transition between paragraphs when the essay is fairly straightforward.
- Make sophisticated distinctions concerning the logical use of conjunctive adverbs or phrases, particularly when signaling a shift between paragraphs.
- Rearrange sentences to improve the logic and coherence of a complex paragraph.
- Add a sentence to introduce or conclude a fairly complex paragraph.
- Consider the need for introductory sentences or transitions, basing decisions on a thorough understanding of both the logic and rhetorical effect of the paragraph and essay.

E3 Word Choice in Terms of Style, Tone, Clarity, and Economy

- Revise sentences to correct awkward and confusing arrangements of sentence elements.
- Revise vague nouns and pronouns that create obvious logic problems.
- Delete obviously synonymous and wordy material in a sentence.
- Revise expressions that deviate from the style of an essay.
- Delete redundant material when information is repeated in different parts of speech (e.g., *alarmingly startled*).
- Use the word or phrase most consistent with the style and tone of a fairly straightforward essay.
- Determine the clearest and most logical conjunction to link clauses.
- Revise a phrase that is redundant in terms of the meaning and logic of the entire sentence.
- Identify and correct ambiguous pronoun references.
- Use the word or phrase most appropriate in terms of the content of the sentence and tone of the essay.
- Correct redundant material that involves sophisticated vocabulary and sounds acceptable as conversational English (e.g., *an aesthetic viewpoint* versus *the outlook of an aesthetic viewpoint*).
- Correct vague and wordy or clumsy and confusing writing containing sophisticated language.
- Delete redundant material that involves subtle concepts or that is redundant in terms of the paragraph as a whole.

E4 Sentence Structure and Formation

- Use conjunctions or punctuation to join simple clauses.
- Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences.
- Determine the need for punctuation and conjunctions to avoid awkward-sounding sentence fragments and fused sentences.
- Decide the appropriate verb tense and voice by considering the meaning of the entire sentence.
- Recognize and correct marked disturbances of sentence flow and structure (e.g., participial phrase fragments, missing or incorrect relative pronouns, dangling or misplaced modifiers).
- Revise to avoid faulty placement of phrases and faulty coordination and subordination of clauses in sentences with subtle structural problems.
- Maintain consistent verb tense and pronoun person on the basis of the preceding clause or sentence.
- Use sentence-combining techniques, effectively avoiding problematic comma splices, run-on sentences, and sentence fragments, especially in sentences containing compound subjects or verbs.
- Maintain a consistent and logical use of verb tense and pronoun person on the basis of information in the paragraph or essay as a whole.
- Work comfortably with long sentences and complex clausal relationships within sentences, avoiding weak conjunctions between independent clauses and maintaining parallel structure between clauses.

E5 Conventions of Usage

- Solve such basic grammatical problems as how to form the past and past participle of irregular but commonly used verbs and how to form comparative and superlative adjectives.
- Solve such grammatical problems as whether to use an adverb or adjective form, how to ensure straightforward subject–verb and pronoun–antecedent agreement, and which preposition to use in simple contexts.
- Recognize and use the appropriate word in frequently confused pairs such as *there* and *their*, *past* and *passed*, and *led* and *lead*.
- Use idiomatically appropriate prepositions, especially in combination with verbs (e.g., *long for*, *appeal to*).
- Ensure that a verb agrees with its subject when there is some text between the two.
- Ensure that a pronoun agrees with its antecedent when the two occur in separate clauses or sentences.
- Identify the correct past and past participle forms of irregular and infrequently used verbs and form present–perfect verbs by using *have* rather than *of*.
- Correctly use reflexive pronouns, the possessive pronouns *its* and *your*, and the relative pronouns *who* and *whom*.
- Ensure that a verb agrees with its subject in unusual situations (e.g., when the subject–verb order is inverted or when the subject is an indefinite pronoun).
- Provide idiomatically and contextually appropriate prepositions following verbs in situations involving sophisticated language or ideas.
- Ensure that a verb agrees with its subject when a phrase or clause between the two suggests a different number for the verb.

E6 Conventions of Punctuation

- Delete commas that create basic sense problems (e.g., between verb and direct object).
- Provide appropriate punctuation in straightforward situations (e.g., items in a series).
- Delete commas that disturb the sentence flow (e.g., between modifier and modified element).
- Use commas to set off simple parenthetical phrases.
- Delete unnecessary commas when an incorrect reading of the sentence suggests a pause that should be punctuated (e.g., between verb and direct object clause).
- Use punctuation to set off complex parenthetical phrases.
- Recognize and delete unnecessary commas based on a careful reading of a complicated sentence (e.g., between the elements of a compound subject or compound verb joined by *and*).
- Use apostrophes to indicate simple possessive nouns.
- Recognize inappropriate uses of colons and semicolons.
- Use commas to set off a nonessential/nonrestrictive appositive or clause.
- Deal with multiple punctuation problems (e.g., compound sentences containing unnecessary commas and phrases that may or may not be parenthetical).
- Use an apostrophe to show possession, especially with irregular plural nouns.
- Use a semicolon to indicate a relationship between closely related independent clauses.
- Use a colon to introduce an example or an elaboration.

Math

Math

M1 Basic Operations and Applications

- Perform one-operation computation with whole numbers and decimals.
- Solve problems in one or two steps using whole numbers.
- Perform common conversions (e.g., inches to feet or hours to minutes).
- Solve routine one-step arithmetic problems (using whole numbers, fractions, and decimals) such as single-step percent.
- Solve some routine two-step arithmetic problems.
- Solve routine two-step or three-step arithmetic problems involving concepts such as rate and proportion, tax added, percentage off, and computing with a given average.
- Solve multistep arithmetic problems that involve planning or converting units of measure (e.g., feet per second to miles per hour).
- Solve word problems containing several rates, proportions, or percentages.
- Solve complex arithmetic problems involving percent of increase or decrease and problems requiring integration of several concepts from pre-algebra and/or pre-geometry (e.g., comparing percentages or averages, using several ratios, and finding ratios in geometry settings).

M2 Probability, Statistics, and Data Analysis

- Calculate the average of a list of positive whole numbers.
- Perform a single computation using information from a table or chart.
- Calculate the average of a list of numbers.
- Calculate the average, given the number of data values and the sum of the data values.
- Read tables and graphs.
- Perform computations on data from tables and graphs.
- Use the relationship between the probability of an event and the probability of its complement.
- Calculate the missing data value, given the average and all data values but one.
- Translate from one representation of data to another (e.g., a bar graph to a circle graph).
- Determine the probability of a simple event.
- Exhibit knowledge of simple counting techniques.*
- Calculate the average, given the frequency counts of all the data values.
- Manipulate data from tables and graphs.
- Compute straightforward probabilities for common situations.
- Use Venn diagrams in counting.*
- Calculate or use a weighted average.
- Interpret and use information from figures, tables, and graphs.
- Apply counting techniques.
- Compute a probability when the event and/or sample space is not given or obvious.
- Distinguish between mean, median, and mode for a list of numbers.
- Analyze and draw conclusions based on information from figures, tables, and graphs.
- Exhibit knowledge of conditional and joint probability.

M3 Numbers: Concepts and Properties

- Recognize equivalent fractions and fractions in lowest terms.

- Recognize one-digit factors of a number.
- Identify a digit's place value.
- Exhibit knowledge of elementary number concepts including rounding, the ordering of decimals, pattern identification, absolute value, primes, and greatest common factor.
- Find and use the least common multiple.
- Order fractions.
- Work with numerical factors.
- Work with scientific notation.
- Work with squares and square roots of numbers.
- Work problems involving positive integer exponents.*
- Work with cubes and cube roots of numbers.*
- Determine when an expression is undefined.*
- Exhibit some knowledge of the complex numbers.†
- Apply number properties involving prime factorization.
- Apply number properties involving even and odd numbers and factors and multiples.
- Apply number properties involving positive and negative numbers.
- Apply rules of exponents.
- Multiply two complex numbers.†
- Draw conclusions based on number concepts, algebraic properties, and/or relationships between expressions and numbers.
- Exhibit knowledge of logarithms and geometric sequences.
- Apply properties of complex numbers.

M4 Expressions, Equations, and Inequalities

- Exhibit knowledge of basic expressions (e.g., identify an expression for a total as $b + g$).
- Solve equations in the form $x + a = b$, where a and b are whole numbers or decimals.
- Substitute whole numbers for unknown quantities to evaluate expressions.
- Solve one-step equations having integer or decimal answers.
- Combine like terms (e.g., $2x + 5x$).
- Evaluate algebraic expressions by substituting integers for unknown quantities.
- Add and subtract simple algebraic expressions.
- Solve routine first-degree equations.
- Perform straightforward word-to-symbol translations.
- Multiply two binomials.*
- Solve real-world problems using first-degree equations.
- Write expressions, equations, or inequalities with a single variable for common pre-algebra settings (e.g., rate and distance problems and problems that can be solved by using proportions).
- Identify solutions to simple quadratic equations.
- Add, subtract, and multiply polynomials.*
- Factor simple quadratics (e.g., the difference of squares and perfect square trinomials).*
- Solve first-degree inequalities that do not require reversing the inequality sign.*
- Manipulate expressions and equations.
- Write expressions, equations, and inequalities for common algebra settings.
- Solve linear inequalities that require reversing the inequality sign.
- Solve absolute value equations.
- Solve quadratic equations.

- Find solutions to systems of linear equations.
- Write expressions that require planning and/or manipulating to accurately model a situation.
- Write equations and inequalities that require planning, manipulating, and/or solving.
- Solve simple absolute value inequalities.

M5 Graphical Representations

- Identify the location of a point with a positive coordinate on the number line.
- Locate points on the number line and in the first quadrant.
- Locate points in the coordinate plane.
- Comprehend the concept of length on the number line.*
- Exhibit knowledge of slope.*
- Identify the graph of a linear inequality on the number line.*
- Determine the slope of a line from points or equations.*
- Match linear graphs with their equations.*
- Find the midpoint of a line segment.*
- Interpret and use information from graphs in the coordinate plane.
- Match number line graphs with solution sets of linear inequalities.
- Use the distance formula.
- Use properties of parallel and perpendicular lines to determine an equation of a line or coordinates of a point.
- Recognize special characteristics of parabolas and circles (e.g., the vertex of a parabola and the center or radius of a circle).†
- Match number line graphs with solution sets of simple quadratic inequalities.
- Identify characteristics of graphs based on a set of conditions or on a general equation such as $y = ax^2 + c$.
- Solve problems integrating multiple algebraic and/or geometric concepts.
- Analyze and draw conclusions based on information from graphs in the coordinate plane.

M6 Properties of Plane Figures

- Exhibit some knowledge of the angles associated with parallel lines.
- Find the measure of an angle using properties of parallel lines.
- Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90° , 180° , and 360°).
- Use several angle properties to find an unknown angle measure.
- Recognize Pythagorean triples.*
- Use properties of isosceles triangles.*
- Apply properties of 30° - 60° - 90° , 45° - 45° - 90° , similar, and congruent triangles.
- Use the Pythagorean theorem.
- Draw conclusions based on a set of conditions.
- Solve multistep geometry problems that involve integrating concepts, planning, visualization, and/or making connections with other content areas.
- Use relationships among angles, arcs, and distances in a circle.

M7 Measurement

- Estimate or calculate the length of a line segment based on other lengths given on a geometric figure.
- Compute the perimeter of polygons when all side lengths are given.
- Compute the area of rectangles when whole number dimensions are given.
- Compute the area and perimeter of triangles and rectangles in simple problems.
- Use geometric formulas when all necessary information is given.
- Compute the area of triangles and rectangles when one or more additional simple steps are required.
- Compute the area and circumference of circles after identifying necessary information.
- Compute the perimeter of simple composite geometric figures with unknown side lengths.*
- Use relationships involving area, perimeter, and volume of geometric figures to compute another measure.
- Use scale factors to determine the magnitude of a size change.
- Compute the area of composite geometric figures when planning or visualization is required.

M8 Functions

- Evaluate quadratic functions, expressed in function notation, at integer values.
- Evaluate polynomial functions, expressed in function notation, at integer values.†
- Express the sine, cosine, and tangent of an angle in a right triangle as a ratio of given side lengths.†
- Evaluate composite functions at integer values.†
- Apply basic trigonometric ratios to solve right-triangle problems.†
- Write an expression for the composite of two simple functions.†
- Use trigonometric concepts and basic identities to solve problems.†
- Exhibit knowledge of unit circle trigonometry.†
- Match graphs of basic trigonometric functions with their equations.

Notes

- Students who score in the 1–12 range are most likely beginning to develop the knowledge and skills assessed in the other ranges.
- Standards followed by an asterisk (*) apply to the PLAN and ACT Mathematics Tests only.
- Standards followed by a dagger (†) apply to the ACT Mathematics Test only.

Reading

Reading

R1 Main Ideas and Author's Approach

- Recognize a clear intent of an author or narrator in uncomplicated literary narratives.
- Identify a clear main idea or purpose of straightforward paragraphs in uncomplicated literary narratives.
- Infer the main idea or purpose of straightforward paragraphs in uncomplicated literary narratives.
- Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in uncomplicated passages.

- Identify a clear main idea or purpose of any paragraph or paragraphs in uncomplicated passages.
- Infer the main idea or purpose of straightforward paragraphs in more challenging passages.
- Summarize basic events and ideas in more challenging passages.
- Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in more challenging passages.
- Infer the main idea or purpose of more challenging passages or their paragraphs.
- Summarize events and ideas in virtually any passage.
- Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in virtually any passage.
- Identify clear main ideas or purposes of complex passages or their paragraphs.

R2 Supporting Details

- Locate basic facts (e.g., names, dates, events) clearly stated in a passage.
- Locate simple details at the sentence and paragraph level in uncomplicated passages.
- Recognize a clear function of a part of an uncomplicated passage.
- Locate important details in uncomplicated passages.
- Make simple inferences about how details are used in passages.
- Locate important details in more challenging passages.
- Locate and interpret minor or subtly stated details in uncomplicated passages.
- Discern which details, though they may appear in different sections throughout a passage, support important points in more challenging passages.
- Locate and interpret minor or subtly stated details in more challenging passages.
- Use details from different sections of some complex informational passages to support a specific point or argument.
- Locate and interpret details in complex passages.
- Understand the function of a part of a passage when the function is subtle or complex.

R3 Sequential, Comparative, and Cause–Effect Relationships

- Determine when (e.g., first, last, before, after) or if an event occurred in uncomplicated passages.
- Recognize clear cause–effect relationships described within a single sentence in a passage.
- Identify relationships between main characters in uncomplicated literary narratives.
- Recognize clear cause–effect relationships within a single paragraph in uncomplicated literary narratives.
- Order simple sequences of events in uncomplicated literary narratives.
- Identify clear relationships between people, ideas, and so forth in uncomplicated passages.
- Identify clear cause–effect relationships in uncomplicated passages.
- Order sequences of events in uncomplicated passages.
- Understand relationships between people, ideas, and so forth in uncomplicated passages.
- Identify clear relationships between characters, ideas, and so forth in more challenging literary narratives.

- Understand implied or subtly stated cause–effect relationships in uncomplicated passages.
- Identify clear cause–effect relationships in more challenging passages.
- Order sequences of events in more challenging passages.
- Understand the dynamics between people, ideas, and so forth in more challenging passages.
- Understand implied or subtly stated cause–effect relationships in more challenging passages.
- Order sequences of events in complex passages.
- Understand the subtleties in relationships between people, ideas, and so forth in virtually any passage.
- Understand implied, subtle, or complex cause–effect relationships in virtually any passage.

R4 Meaning of Words

- Understand the implication of a familiar word or phrase and of simple descriptive language.
- Use context to understand basic figurative language.
- Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in uncomplicated passages.
- Use context to determine the appropriate meaning of virtually any word, phrase, or statement in uncomplicated passages.
- Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in more challenging passages.
- Determine the appropriate meaning of words, phrases, or statements from figurative or somewhat technical contexts.
- Determine, even when the language is richly figurative and the vocabulary is difficult, the appropriate meaning of context-dependent words, phrases, or statements in virtually any passage.

R5 Generalizations and Conclusions

- Draw simple generalizations and conclusions about the main characters in uncomplicated literary narratives.
- Draw simple generalizations and conclusions about people, ideas, and so forth in uncomplicated passages.
- Draw generalizations and conclusions about people, ideas, and so forth in uncomplicated passages.
- Draw simple generalizations and conclusions using details that support the main points of more challenging passages.
- Draw subtle generalizations and conclusions about characters, ideas, and so forth in uncomplicated literary narratives.
- Draw generalizations and conclusions about people, ideas, and so forth in more challenging passages.
- Use information from one or more sections of a more challenging passage to draw generalizations and conclusions about people, ideas, and so forth.
- Draw complex or subtle generalizations and conclusions about people, ideas, and so forth, often by synthesizing information from different portions of the passage.

- Understand and generalize about portions of a complex literary narrative.

Science

S1 Interpretation of Data

- Select a single piece of data (numerical or nonnumerical) from a simple data presentation (e.g., a table or graph with two or three variables, a food web diagram).
- Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, axis labels).
- Select two or more pieces of data from a simple data presentation.
- Understand basic scientific terminology.
- Find basic information in a brief body of text.
- Determine how the value of one variable changes as the value of another variable changes in a simple data presentation.
- Select data from a complex data presentation (e.g., a table or graph with more than three variables, a phase diagram).
- Compare or combine data from a simple data presentation (e.g., order or sum data from a table).
- Translate information into a table, graph, or diagram.
- Compare or combine data from two or more simple data presentations (e.g., categorize data from a table using a scale from another table).
- Compare or combine data from a complex data presentation.
- Interpolate between data points in a table or graph.
- Determine how the value of one variable changes as the value of another variable changes in a complex data presentation.
- Identify and/or use a simple (e.g., linear) mathematical relationship between data.
- Analyze given information when presented with new, simple information.
- Compare or combine data from a simple data presentation with data from a complex data presentation.
- Identify and/or use a complex (e.g., nonlinear) mathematical relationship between data.
- Extrapolate from data points in a table or graph.
- Compare or combine data from two or more complex data presentations.
- Analyze given information when presented with new, complex information.

S2 Scientific Investigation

- Understand the methods and tools used in a simple experiment.
- Understand the methods and tools used in a moderately complex experiment.
- Understand a simple experimental design.
- Identify a control in an experiment.
- Identify similarities and differences between experiments.
- Understand the methods and tools used in a complex experiment.
- Understand a complex experimental design.
- Predict the results of an additional trial or measurement in an experiment.
- Determine the experimental conditions that would produce specified results.
- Determine the hypothesis for an experiment.
- Identify an alternate method for testing a hypothesis.
- Understand precision and accuracy issues.

- Predict how modifying the design or methods of an experiment will affect results.
- Identify an additional trial or experiment that could be performed to enhance or evaluate experimental results.

S3 Evaluation of Models, Inferences, and Experimental Results

- Select a simple hypothesis, prediction, or conclusion that is supported by a data presentation or a model.
- Identify key issues or assumptions in a model.
- Select a simple hypothesis, prediction, or conclusion that is supported by two or more data presentations or models.
- Determine whether given information supports or contradicts a simple hypothesis or conclusion and why.
- Identify strengths and weaknesses in one or more models.
- Identify similarities and differences between models.
- Determine which model(s) is/are supported or weakened by new information.
- Select a data presentation or a model that supports or contradicts a hypothesis, prediction, or conclusion.
- Select a complex hypothesis, prediction, or conclusion that is supported by a data presentation or model.
- Determine whether new information supports or weakens a model and why.
- Use new information to make a prediction based on a model.
- Select a complex hypothesis, prediction, or conclusion that is supported by two or more data presentations or models.
- Determine whether given information supports or contradicts a complex hypothesis or conclusion and why.

Writing

W1 Expressing Judgments

- Show a little understanding of the persuasive purpose of the task but neglect to take or to maintain a position on the issue in the prompt.
- Show limited recognition of the complexity of the issue in the prompt.
- Show a basic understanding of the persuasive purpose of the task by taking a position on the issue in the prompt but may not maintain that position.
- Show a little recognition of the complexity of the issue in the prompt by acknowledging, but only briefly describing, a counterargument to the writer's position.
- Show understanding of the persuasive purpose of the task by taking a position on the issue in the prompt.
- Show some recognition of the complexity of the issue in the prompt by doing the following:
 - Acknowledging counterarguments to the writer's position
 - Providing some response to counterarguments to the writer's position
- Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a broad context for discussion.
- Show recognition of the complexity of the issue in the prompt by doing the following:
 - Partially evaluating implications and/or complications of the issue, and/or
 - Posing and partially responding to counterarguments to the writer's position

- Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a critical context for discussion.
- Show understanding of the complexity of the issue in the prompt by doing the following:
 - Examining different perspectives, and/or
 - Evaluating implications or complications of the issue, and/or
 - Posing and fully discussing counterarguments to the writer's position

W2 Focusing on the Topic

- Maintain a focus on the general topic in the prompt through most of the essay.
- Maintain a focus on the general topic in the prompt throughout the essay.
- Maintain a focus on the general topic in the prompt throughout the essay, and attempt a focus on the specific issue in the prompt.
- Present a thesis that establishes focus on the topic.
- Maintain a focus on discussion of the specific topic and issue in the prompt throughout the essay.
- Present a thesis that establishes a focus on the writer's position on the issue.
- Maintain a clear focus on discussion of the specific topic and issue in the prompt throughout the essay.
- Present a critical thesis that clearly establishes the focus on the writer's position on the issue.

W3 Developing a Position

- Offer a little development, with one or two ideas; if examples are given, they are general and may not be clearly relevant; resort often to merely repeating ideas.
- Show little or no movement between general and specific ideas and examples.
- Offer limited development of ideas using a few general examples; resort sometimes to merely repeating ideas.
- Show little movement between general and specific ideas and examples.
- Develop ideas by using some specific reasons, details, and examples.
- Show some movement between general and specific ideas and examples.
- Develop most ideas fully, using some specific and relevant reasons, details, and examples.
- Show clear movement between general and specific ideas and examples.
- Develop several ideas fully, using specific and relevant reasons, details, and examples.
- Show effective movement between general and specific ideas and examples.

W4 Organizing Ideas

- Provide a discernible organization with some logical grouping of ideas in parts of the essay.
- Use a few simple and obvious transitions.
- Present a discernible, though minimally developed, introduction and conclusion.
- Provide a simple organization with logical grouping of ideas in parts of the essay.
- Use some simple and obvious transitional words, though they may at times be inappropriate or misleading.
- Present a discernible, though underdeveloped, introduction and conclusion.

- Provide an adequate but simple organization with logical grouping of ideas in parts of the essay but with little evidence of logical progression of ideas.
- Use some simple and obvious, but appropriate, transitional words and phrases.
- Present a discernible introduction and conclusion with a little development.
- Provide unity and coherence throughout the essay, sometimes with a logical progression of ideas.
- Use relevant, though at times simple and obvious, transitional words and phrases to convey logical relationships between ideas.
- Present a somewhat developed introduction and conclusion.
- Provide unity and coherence throughout the essay, often with a logical progression of ideas.
- Use relevant transitional words, phrases, and sentences to convey logical relationships between ideas.
- Present a well-developed introduction and conclusion.

W5 Using Language

- Show limited control of language by doing the following:
 - Correctly employing some of the conventions of standard English grammar, usage, and mechanics, but with distracting errors that sometimes significantly impede understanding
 - Using simple vocabulary
 - Using simple sentence structure
 - Correctly employing some of the conventions of standard English grammar, usage, and mechanics, but with distracting errors that sometimes impede understanding
 - Using simple but appropriate vocabulary
 - Using a little sentence variety, though most sentences are simple in structure
 - Correctly employing many of the conventions of standard English grammar, usage, and mechanics, but with some distracting errors that may occasionally impede understanding
 - Using appropriate vocabulary
 - Using some varied kinds of sentence structures to vary pace
 - Correctly employing most conventions of standard English grammar, usage, and mechanics with a few distracting errors but none that impede understanding
 - Using some precise and varied vocabulary
 - Using several kinds of sentence structures to vary pace and to support meaning
 - Correctly employing most conventions of standard English grammar, usage, and mechanics with just a few, if any, errors
 - Using precise and varied vocabulary
 - Using a variety of kinds of sentence structures to vary pace and to support meaning

Appendix D:

National Educational Technology Standards for Students

- T1** Creativity and Innovation
 - T2** Communication and Collaboration
 - T3** Research and Information Fluency
 - T4** Critical Thinking, Problem Solving, and Decision Making
 - T5** Digital Citizenship
 - T6** Technology Operations and Concepts
-
- T1** Creativity and Innovation
Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:
 - a. apply existing knowledge to generate new ideas, products, or processes.
 - b. create original works as a means of personal or group expression.
 - c. use models and simulations to explore complex systems and issues.
 - d. identify trends and forecast possibilities.
 - T2** Communication and Collaboration
Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:
 - a. interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
 - b. communicate information and ideas effectively to multiple audiences using a variety of media and formats.
 - c. develop cultural understanding and global awareness by engaging with learners of other cultures.
 - d. contribute to project teams to produce original works or solve problems.
 - T3** Research and Information Fluency
Students apply digital tools to gather, evaluate, and use information. Students:
 - a. plan strategies to guide inquiry.
 - b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
 - c. evaluate and select information sources and digital tools based on the appropriateness to specific tasks.
 - d. process data and report results.
 - T4** Critical Thinking, Problem Solving, and Decision Making
Students use critical-thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:
 - a. identify and define authentic problems and significant questions for investigation.
 - b. plan and manage activities to develop a solution or complete a project.
 - c. collect and analyze data to identify solutions and/or make informed decisions.
 - d. use multiple processes and diverse perspectives to explore alternative solutions.

T5 Digital Citizenship

Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:

- a. advocate and practice safe, legal, and responsible use of information and technology.
- b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.
- c. demonstrate personal responsibility for lifelong learning.
- d. exhibit leadership for digital citizenship.

T6 Technology Operations and Concepts

Students demonstrate a sound understanding of technology concepts, systems, and operations. Students:

- a. understand and use technology systems.
- b. select and use applications effectively and productively.
- c. troubleshoot systems and applications.
- d. transfer current knowledge to learning of new technologies.